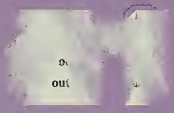
OFFICE OF POPULATION CENSUSES AND SURVEYS
SOCIAL SURVEY DIVISION

The heights and weights of adults in Great Britain

Report of a survey carried out on behalf of the Department of Health and Social Security covering adults aged 16–64

Ian Knight



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assisted by
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1 Background to the study and methodology

Background and purpose

This is a report on the first fully representative survey of heights and weights ever to be undertaken among the adult population of Great Britain. Apart from the importance of height and weight measurements in their own right, the Department of Health have also been concerned to relate the two measures as a guide to the prevalence of obesity.

The view is sometimes expressed both in the medical profession, and among the public at large, that the British are becoming overweight, and that this is responsible at least in part for the increase in deaths from heart disease which has been described in recent years as an epidemic.[1,2] Overweight people are also at greater risk from a number of other ailments including high blood pressure, diabetes, osteo arthritis and gall bladder disease. Against this background the Department of Health and Social Security commissioned the survey as part of their programme of nutritional surveillance both as a national benchmark against which special regional studies could be compared and as a starting point for future monitoring of height and weight in the population.

In reviewing the available data on the general adult population (prior to this survey) the Medical Research Council report on obesity[2] regretted the lack of up to date information. The report pointed out that such studies as had been conducted were not representative of the whole of Britain and that the methodology and categorisation used in different studies were not comparable. The data used to represent the national picture before this survey have usually been taken from the Kemsley anthropometric studies[3] in the 1940s or from life assurance tables. For a number of technical reasons Kemsley was unable to use a statistically representative sample when he gathered most of his data in 1943. Instead his measurements came from a series of samples which could not be combined. A panel of mineworkers were measured by medical officers at the mines and a similar approach was used for a panel of workers in a sample of large firms. Samples of workers in small firms, and housewives, were contacted by a market research agency and were actually measured at local chemist shops using the equipment already installed there, which meant there was very limited control over measurement technique.

The life assurance tables most commonly used come from the Metropolitan Life Assurance Company of New York and although these tables have the benefit of relating height and weight to mortality, they also have several drawbacks. The information comes from applicants for life insurance policies, which restricted the sample to those who applied for insurance of such value that a medical examination was necessary. The insurance tables of height and weight are also classified by 'frame size' but since this concept is not clearly defined it presents further problems of interpretation.*

Sample design and response

The survey was designed to be representative of the British population aged 16–64 inclusive. Resources were concentrated on this working age group because other research data already existed for the young and the elderly.[4]

The sample was based on a multistage design to cover all eligible individuals in a sample of 5,000 households; on average, two individuals were eligible in each household. The sample was drawn from a random selection of 100 Local Authority districts stratified by type (metropolitan and non-metropolitan) within region, and by social class. In each district two wards were randomly selected and within each selected ward a random sample of households was selected from the electoral register. Further details of the sample design are given in Appendix A.

Interviews were achieved in 82% of all eligible households, and 79% of all eligible adults were weighed and measured. From interviewer reports it appears that only 1% of the sampled people refused to co-operate because they would have to be weighed, the remaining refusals being for reasons unrelated to the subject matter of the survey.

The achieved sample of 10,018 adults† weighed and measured was made up of 48% men and 52% women, but since men and women are always analysed separately this small imbalance is of no consequence. However, the comparison of the achieved sample distribution with national population estimates by age and region also shows a minor bias. Slightly too few people under 30 and too many in their forties were interviewed and measured.

Similarly London was under-represented in the achieved sample as was South East while the Northern region was over-represented. These small biases have

* The frame size concept is discussed further in Chapter 4.

† Some 5% of these are not included in the report tables for technical reasons which are explained on page 6.

been corrected by post-stratifying the sample, separately for men and women, at the data processing stage.

Further details of response rates and post-stratification are given in Appendix A.

To achieve a nationally representative sample it was essential that the people selected were contacted, interviewed, and measured. Yet any attempt to persuade people to leave their homes and attend a centre for measurement would have risked a very poor response rate which would have seriously limited the representativeness of the results. To overcome this problem measurements and interviews were carried out at the subject's own home. This approach allowed OPCS trained interviewer fieldworkers to work in a way familiar to them, with the likelihood of maximising the response from the public, but it did pose problems with regard to the type of techniques and equipment that could be employed for the measurements.

Fieldwork dates

Since the survey fieldwork was nearly all undertaken in August and September 1980 it is reasonable to ask how typical this period was of the rest of the year. The Kemsley anthropometric studies did include successive quarterly weighings of a sub-sample, and although this group was not representative of the general population, the seasonal variations within the sample do provide a useful indicator of change in weight over the course of a year. His result showed that, on average, adult weight increased by about ¾ kilo from a July minimum to a January maximum. But the bulk of the sample were weighed fully clothed and nude weight was approximated by the standard deduction for clothing, so part of the difference was accounted for by the lighter clothing worn in the summer.[5] Kemsley estimated a trend level for the 12 month period and showed that by October his subjects were, on average, more than half way towards their maximum seasonal weight, so it might reasonably be inferred that September would have been the most 'neutral' month for fieldwork. However the overall magnitude of the seasonal effect would appear to be so small as to suggest that the field work season is immaterial so long as the measurement period is short enough to show little seasonal effect within its duration.

Equipment

Any equipment used had to be portable, from one household to another, so that a female fieldworker-interviewer who would be visiting several households in an evening could carry it easily. In addition the equipment had to be small enough to be carried in small cars, on public transport, and within blocks of flats, into lifts and up stairways. Thus compactness and portability were almost as important as reliability and ease of use by a single fieldworker.

The scales

After investigation of readily available models,* the eventual choice was the Seca 760, a relatively light-weight (about 3 kilos) spring balance scale with a large platform and dial. Spring balance scales are not as accurate or reliable as beam balance devices but all the latter were found to be very heavy and usually bulky. The only beam balance design of suitable portable dimensions weighed about 18 kilos and this together with the stadiometer would have been an impractical burden for an interviewer to carry.

The scales were purchased from a specialist supplier, who checked and calibrated the units before delivery, accurate to the nearest division of dial (exceeding the DIN standard) and fitted the dial† in a reversed position. This permitted the interviewer to read the dial, the right way round, to the nearest 0.5 kilos. A further modification to the standard scales was the fitting of a transit lock that prevented movement of the internal rack and spring mechanism whilst the unit was being carried. Each interviewer was equipped with a carrying bag to take the scales and survey documents.

Stadiometer design

Commercially available stadiometers that offered accuracy to 1mm tended to be wall mounted or free-standing models of considerable weight and complexity. Earlier trials carried out to test public response to such a survey and to evaluate equipment, had used both tape devices and a crude telescopic rigid stadiometer. The former proved mechanically unreliable, damage prone, and too difficult for interviewers to handle and achieve reliable results with tall subjects, while the rigid device was unstable and difficult for a measurer to use without an assistant.

In consequence two companies with experience in manufacturing anthropometric equipment developed designs in discussion with OPCS and built prototypes to performance, dimension and budget specifications laid down by OPCS. These designs were then tested both in office based trials and in field tests by interviewers. They were also shown to, and tried by, several leading anthropometric researchers in London based institutions.[6] These tests showed that a folding design proposed by CMS§ was easiest to set up, since it did not have separate pieces requiring assembly and dismantling at each household, was easy to transport, and was relatively simple to use. For the main field work a more rigid and slightly simplified version of this device, improved by the experience of the trials, was produced by the same contractor.

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* Several makes and types of scales were considered. Weight, ease of reading the face, platform size and likely reliability, availability and price were the main criteria influencing choice. Preliminary investigation suggested the Seca 760 as being nearest to the required specification, and it was noted that this model was known to and used by some medical research teams. Ten Secas were purchased – calibrated for accuracy by the supplier – and used in a series of feasibility experiments and field trials. At the end of heavy and protracted use the units were rechecked for accuracy and only one unit was inaccurate beyond one division of the dial (ie the printed graduations).

† The dial fitted was numbered in 10 kilo steps with intermediate 1 kilo and 0.5 kilo calibrations represented by lines and dots respectively. The clarity of the markings and point thickness were such as to make reading to the nearest 0.5 kilo unambiguous.

Beside the considerations already mentioned the stadiometer design had to meet other design requirements. Informants would be asked to stretch upwards whilst being measured, hence the measurement arm had to move with this stretch. Also, since on many occasions interviewers would be smaller than their subjects, it was important that the measurement arm should not slip from its final position at the achieved height.

Figure 1.1 shows the measurement head mounted on the upper section of the stadiometer. The main features are: the head slides very freely on roller bearings (i) and the self-setting friction lock (ii) which permits damped upward movement as the subject stretches but resists downward movement until the lock is released.

This allowed small fieldworkers to retain the measured height on the stadiometer, until after the subject had stepped off the platform when the device could be tilted to achieve a parallax free reading from the cursor (iii).

When folded a captive spring clip mounted on the baseboard locked the whole assembly for safety in transit.

Problems of stance and stretch in height measurement

It was recognised from the start that reliable measurement of human height raises several problems. The erect height of a person tends to decline as the day progresses and people can alter their height by the posture they adopt. A commonly used clinical technique is that of a supported stretch, where the measurer supports the subject's head allowing the maximum height to be obtained.[6]

This technique is a very reliable method for children, and can be successful with adults (under certain conditions). However the OPCS field trials showed that the technique was very difficult with only one measurer, particularly when the subject was taller than the measurer. The results from these studies suggested that the supported stretch technique would, under the fieldwork conditions, produce a more variable result and a *lower* average height than a simpler unsupported stretch where the measurer could concentrate on other vital postural points.

For this reason an unsupported stretch technique was adopted. (Having reached this conclusion, information from a major American[7] survey became available, which also proved to be based on an unsupported stretch technique). Both the techniques used by OPCS and those used in the USA, closely follow the principles laid down by approved international standards.*

All these methods demand the correct positioning of the subjects. Briefly, this requires subjects to stand with their feet together, their arms loosely by their sides and to allow the interviewer to position their head in the Frankfort Plane.

The head position (Frankfort Plane)

A natural reaction for most people, when asked to attain maximum height is to raise their eye level by tilting their chin upwards. Unfortunately this has the opposite effect, as the highest point is usually the crown of the head, and to bring this into prominence requires the chin to be lowered by tilting the head forwards. To place the subject's head in this optimum position for height measurement (known as the Frankfort Plane) a line must be imagined passing through the external auditory meatus (the small flap of skin on the forward edge of the ear) and across the top of the lower bone of the eye socket immediately under the eye. This line must be parallel to the floor ie horizontal. A nodding head 'display' card was used to explain this requirement as few people would adopt such a posture naturally (see Figure 1.2).

Field procedure

The following procedure for measurements was adopted in the field.

1 Subjects were asked to remove their shoes, and heavy outer garments. Fieldworkers demonstrated the Frankfort Plane position to the household, and issued a self completion form for the subject to list clothing being worn.

2 The equipment was set up, with scales on a hard flat surface.

3 The subject was positioned on the scales platform and asked to look straight ahead, standing relaxed but still. The interviewer would then take a weight reading from the dial. Scales were always re-zeroed before each weighting.

4 The subject was then positioned on the stadiometer. All fieldworkers were trained to follow a standard procedure.†

   (a) Check that subject's feet were together and centrally placed on the baseboard, and that legs were together and heels against the back plate, flat on the board.

   (b) Check that the subject's arms were held loosely by his side.

   (c) Check Frankfort Plane position (using a straight edge).

   (d) Ask the subject to stretch himself with the request *"Now stand up as tall as you can"*. (Interviewers checked that a height increase occurred).

° The researchers gratefully acknowledge the advice of the Institute of Child Health (Dr N Cameron), London School of Hygiene and Tropical Medicine (Dr P Fox, Mrs Griffiths and colleagues), St Thomas Hospital and Dept of Community Medicine (Dr R Rona and fieldworkers) and to the many other specialists in this field with whom they made contact.

§ CMS Ltd 18 Camden High Street, London NW1 0JH.

* See IBP Handbook[6] – though deviating in the stretch technique as described above.

† Fieldworker technique was checked regularly, see next section.

Figure 1.1 The Stadiometer

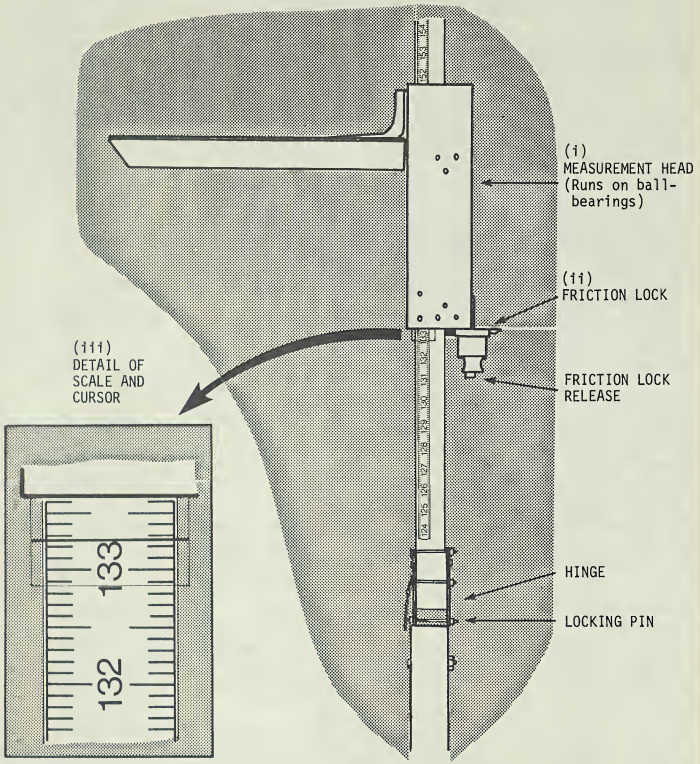

Figure 1.2 Display card

Display card set to show head position required for maximum height.

Display card set to show how changing of head position by raising eye line reduces attained height.

(e) Recheck the head position (Frankfort Plane), and heels before accepting the measurement.

In cases where the heel or Frankfort Plane positioning was lost or a height increase did not occur† the informant was asked to relax, the stadiometer reset and the procedure repeated, with any faults in positioning corrected.

Measures taken to ensure accuracy

The scales were checked at the start of each week at local Trading Standards (Weights and Measures) Offices.* Standard 10 kilo weights were used to check for accuracy at 10 kilo intervals. In any case where a scale was inaccurate beyond 0.5 kilos the instrument was returned via Head Office to the supplier for recalibration.

The stadiometers were checked before issue to fieldworkers and were so designed that only obvious physical damage would cause them to give inaccurate measurements. But the central concern in the measurement of height was that the interviewers should not forget the special techniques in which they had been trained.

All fieldworkers had to pass a technique test before they were allowed to begin fieldwork. Once fieldwork had begun, each interviewer was called in again after two weeks to a regional checking centre for a further technique test.† Fieldworkers with large quotas who were not able to finish their assignment within a further two weeks were scheduled for an additional technique test.

At the testing session each fieldworker was required to demonstrate the technique to the checker and then to measure successfully the checker's full height to within 4mm.ø When the checker was being measured he or she would deliberately adopt a posture that the interviewer had to put right to achieve a correct measurement. These checkers were all OPCS full time field work trainers who had been specially taught how to administer the technique tests by the researchers. The checkers were periodically tested by the researchers to ensure

† Subjects sometimes inflated their chests and leaned forward without achieving any increase in height. This was corrected by persuading the subject to breathe out as he stretched up when remeasured.

* This amounted on average, to an accuracy test once every 30–40 weighings.

† Fieldworkers working some considerable distance from the nearest regional checking centre were visited by a checker who administered the test and also accompanied them on some field work visits.

ø Had any fieldworker failed the test, a sample of her addresses would have been revisited by the checker to remeasure some subjects; but fortunately this did not prove necessary.

that the former were administering the tests satisfactorily. A DHSS observer attended both the initial training and some of the technique testing sessions.

Field trials with the weighing scales showed that they could give biased readings if not placed on a hard flat surface. Where this was not possible fieldworkers were instructed to continue with the weighing but to code the recorded reading to show that this problem had arisen. All data coded in this way, which were 4% of all readings, have been excluded from the report as a source of possible bias. Fieldworkers were also instructed to mark specially the recorded heights of subjects who could not, or would not, adopt the required posture and 1% of all height measurements have been excluded to remove this additional source of bias.

Problems of estimating nude weight

Since it was obviously not possible for interviewers to obtain nude weight, subjects were measured wearing normal indoor clothing. Nevertheless, in order to provide best estimates of nude weight some allowance had to be made for clothing. In the past surveys have usually made a standard allowance for clothing weight* but in this study it was decided to attempt a specific estimate of clothing weight for each subject.† Each subject was asked to tick off on a check list each item of clothing they were wearing when weighed. (Anyone wearing an item not on the check list was asked to write it down at the end of the list.) At the computing stage estimated weights[a] were attached to each of the items ticked and these weights were summed to produce an estimated clothing weight. In all the weight related tables of this report the estimated clothing weight has been deducted from the measured weight.

Table conventions in the report

All percentages shown in this report have been rounded to the nearest whole number with 0.5 being rounded up, which means that columns of percentages will not always add up to 100. Percentages amounting to a non-zero figure of less than 0.5 have been shown as 0, and the absence of any data at all has been signified by a hyphen. Cases for which the tabulated item has no answer have been omitted from the tables but for any table where this omission represents more than one per cent of cases that fact is mentioned in the accompanying text,* as already mentioned, tables relying on height omit the unreliable height measures, those relying on weight omit unreliable weight measures, and those tables relying on both omit any case which is unreliable on either measure. Consequently tables for height, weight and height by weight are each based on different totals.

Since the sample has been post-stratified to give the same age, sex and regional distribution as the population, the data are weighted and the number of subjects will usually have a non-integer value. However to avoid overburdening the tables with decimal places, the number of subjects has always been shown rounded to the nearest whole number, in the same way as the percentages.

All measurements are shown in the metric units in which they were taken and imperial conversions are only given (selectively) in the text of the report.

Results for males and females are always shown separately.

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* See Kemsley[3] (page 165) for information on the British 1943 study and Abraham[7] (page 35) for details of the USA 1960–62 and 1971–74 studies.

† Kemsley[9] acknowledges that this approach would be desirable (page 316).

[a] A group of 57 volunteers (27 men and 30 women) was issued with special spring balances and asked to weigh a specified list of their clothes. It was thought that younger people would dress in more varied ways and the volunteer group was made up of two thirds people up to age 35 and one third over 35. The reported weights were scanned and for each clothing item up to three extreme values were deleted; the remaining values were averaged to produce estimated clothing weights.

*The one exception to this rule is social class. For technical reasons it is sometimes impossible to allocate a social class code and tables based on social class omit 6% of sampled men and 11% of sampled women.

2 Height distribution of the population

This chapter shows the height distribution of the adult population aged 16–64 analysed by social and demographic variables. It closes with an examination of behavioural variables traditionally associated with height.

Figure 2.1 shows the distribution of male and female heights for the adult population of Great Britain aged from 16–64. The average height of men in the survey sample was 173.9cms (5′ 8$\frac{3}{4}$″) and for women it was 160.9cms (5′ 3$\frac{1}{2}$″). Within this age range most of the men in the 16–19 age group would still be growing but if they are excluded from the calculation of average height the results for men 20–64 only change by a millimetre to 173.8cms.

The median and modal values for height are very close to the averages because the height distributions are essentially normal (in the statistical sense).

Height by age

Since the ageing process in humans tends to reduce height, it was to be expected that the distribution of height would show some decline with age. But the survey data are, in effect, a snapshot of the population at the time of fieldwork, and the different averages in each age group may be due to different patterns of nutrition, upbringing and lifestyle in successive generations (or some other secular factors). So, for example, it cannot be assumed that the average height of 30 year old men now will be the same as that of the men currently 50 in 20 years' time.* Indeed, there is evidence of a secular trend towards increased height in successive generations over recent years.†

The maximum average height occurred among the 22 year old men, 176.6cms (5′ 9$\frac{1}{2}$″) but this was not significantly greater than that for 21 year old men and the maximum average height in the population could have been at either of those two ages. From that clear peak in the early twenties the average height of men falls with successive age groups down to an average of 170.4cms (5′ 7″) at 60–64 years of age (Table 2.1).

Among the women however, there was no such clear peak. The differences between consecutive age group averages for the younger women are not statistically significant. The marginally lower average among the 20–24 age group is caused by a slightly higher proportion of very short women – under 150cms (4′ 11″) – than in the other young age groups. But apart from this slight difference in the 20–24 age group, the female age groups under 35 can be seen as having similar average heights of around 161.7cms (5′ 3$\frac{3}{4}$″) and the decline among the older age groups does not seem to be evident among women until the late thirties age group.

Where possible, the results of this survey will be compared with data from a major survey conducted in the United States of America during the years 1971–74, known as the Health and Nutrition Examination Survey (HANES).[a]

The American survey showed differences in height by 'race' but the racial composition of the ethnic minorities in the British population was thought to be very different, and for the purposes of this report, the most comparable group for the two surveys was the 'white' population.§

Figure 2.2 plots the average heights for different age groups among men and women, showing both the British and American data. In both countries the average height of men falls in successive age groups, though it is clear that the white American men are taller than their British counterparts. Among the women too, there was a downward trend in average height in both nations for age groups beyond 40, but in the younger age groups the picture was less clear cut.

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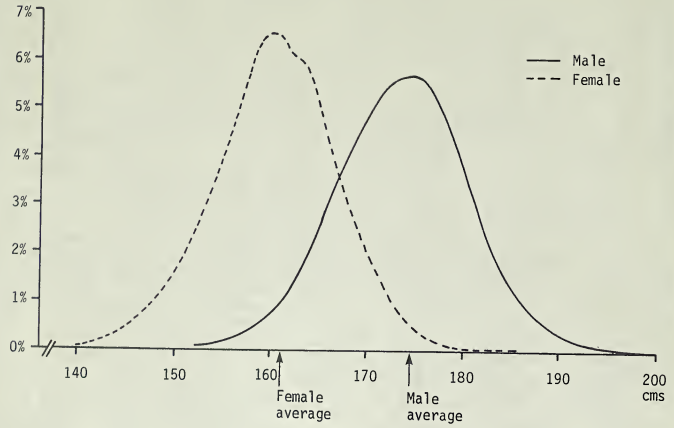
* Only a cohort study following up the same individuals over a long period of time could really show the association of decreasing height with age and even then, only for the generations from which the cohorts were originally selected.

† Although the data from Kemsley's anthropometric samples are not really additive and may not be statistically representative, they are sometimes used to give indication of average height in 1943. The male average over the three samples was 167.7cms (5′ 6″), and for females it was 157.2cms (5′ 2″). [Data from Tables 2 and 3 on p 169 of Kemsley (1950).] Thus the data do suggest an increase in average height since 1943. (Although the Kemsley data excluded servicemen and it could be argued that this would bias male heights downwards, the same argument could not be applied to women.) Also see Abraham[7] for comparisons over a 10 year period for the USA.

[a] See Abraham.[7,9] The American survey covered the age range 18–74, but for comparative purposes people aged 65–74 have been taken out of the HANES results. This still leaves an American sample size of over 10,000.

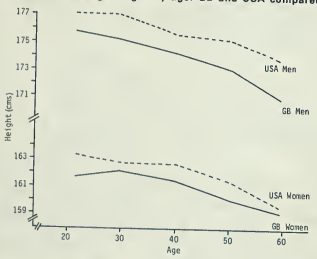
§ Race is a rather vague concept and definitions tend to be somewhat arbitrary. The attribute which the HANES survey labels as race is mainly based on skin colour (white, black or other) with a general presumption that people from Central or Latin America were white unless interviewer observation clearly placed them in the 'black' or 'other' group. The British colour classification was also based on interviewer observation and was reduced to two categories; white and coloured.

Figure 2.1 Height distribution



Figures 2.3 and 2.4 compare the distribution of height for each age and sex group in the white population. The peaks of the American distributions generally appear slightly further along the height range confirming that they are taller than the British subjects. However, the general shape of the height distributions for British women were similar to their American counterparts. Among the men there was a slightly greater spread in the American distributions than the British in the same age groups implying a marginally greater mixture of heights.

Figure 2.2 Average height by age: GB and USA compared



Source of USA data: HANES 1971-74

Overall, the difference in average heights between the two nations was slightly greater for men (USA 1.8cms taller) than for women (USA 1.2cms taller) but in both cases the Americans were about 1% taller.

Height by social class

Table 2.2 shows average heights by social class within age group and it is clear that there is a class effect on height independent of age and sex. In almost every age group people from households headed by a manual worker were shorter, on average, than people from non-manual worker households. Overall, the average height of men was 175.5cms (5′ 9″) in Social Classes I and II but 172.3cms (5′ 8″) in Social Classes IV and V. Similarly female height in Social Classes I and II was 162.5cms (5′ 4″) compared with 159.6cms (5′ 3″) in classes IV and V.

Height by region

Table 2.3 shows the regional and national distributions of height for adults in Britain. In fact these differences were not very great though it is clear that both male and female residents of Wales were significantly shorter, on average, than the rest of the population. Men and women in Scotland also tended to be marginally shorter than the British average while those living in South West and South East (excluding London) were taller than average. The North and North West were similar to Scotland. In the East Midlands and East Anglia the men tended to be taller than the national average,

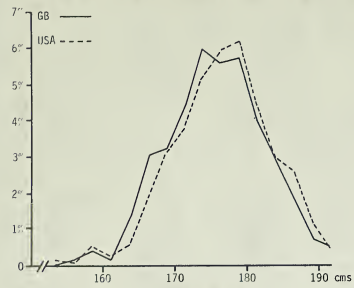
Table 2.1 Percentage distribution of height by age and sex

Height (cm)	All ages 16–64	16–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64
	%	%	%	%	%	%	%	%	%	%	%
	Men										
Up to 160	2	2	2	1	2	2	2	3	1	5	6
160.1–162.5	2	2	0	1	2	2	1	3	4	3	5
162.6–165.0	5	4	3	6	3	3	6	5	7	9	10
165.1–167.5	8	5	8	7	6	5	9	8	11	11	12
167.6–170.0	12	10	8	9	12	11	13	11	13	15	17
170.1–172.5	13	15	9	13	11	13	16	14	12	17	15
172.6–175.0	14	13	15	13	12	13	13	18	17	14	13
175.1–177.5	14	17	13	13	18	19	13	11	11	12	9
177.6–180.0	12	14	13	14	11	15	11	13	11	6	9
180.1–182.5	7	8	10	9	8	6	8	7	3	5	3
182.6–185.0	5	5	9	6	6	6	6	4	5	2	1
185.1–187.5	3	2	5	5	5	2	2	2	2	1	1
187.6–190.0	1	2	2	2	3	1	0	1	1	1	0
190.1–193.5	1	0	1	1	1	0	0	0	1	0	—
Over 193.5	0	1	1	0	0	—	0	1	—	0	—
Base	*4,702*	*500*	*537*	*557*	*541*	*481*	*453*	*415*	*441*	*446*	*338*
Average value	173.9	174.6	176.0	175.3	174.9	174.5	173.6	173.6	172.6	171.1	170.4
Median value	173.8	175.3	176.3	175.3	175.3	175.3	173.3	173.8	172.8	171.3	170.3
Standard error of average	0.14	0.34	0.32	0.31	0.32	0.30	0.29	0.32	0.31	0.36	0.40
	Women										
Up to 150	4	2	4	2	2	3	3	3	5	4	8
150.1–152.5	5	4	5	4	3	4	4	6	6	6	9
152.6–155.0	8	6	7	6	7	8	9	9	9	12	11
155.1–157.5	13	11	11	11	12	12	13	13	18	15	16
157.6–160.0	16	19	14	16	16	14	17	17	18	20	14
160.1–162.5	15	16	15	16	15	19	14	14	13	16	15
162.6–165.0	15	15	16	15	17	16	14	16	14	11	12
165.1–167.5	10	11	12	12	12	9	12	10	6	8	5
167.6–170.0	7	8	9	8	7	7	8	7	7	5	6
170.1–172.5	4	5	4	4	5	4	4	3	3	2	1
172.6–175.0	2	2	2	3	2	2	1	2	2	1	1
175.1–177.5	1	1	1	1	1	1	1	1	—	1	0
Over 177.5	0	0	0	1	1	1	0	0	—	0	—
Base	*5,158*	*523*	*582*	*576*	*583*	*516*	*498*	*439*	*519*	*503*	*420*
Average value	160.9	161.7	161.5	161.8	161.9	161.3	161.0	160.7	159.7	159.5	158.5
Median value	160.8	161.3	161.8	161.8	162.3	161.3	160.8	160.3	159.8	159.3	158.8
Standard error of average	0.11	0.29	0.27	0.32	0.21	0.28	0.24	0.30	0.28	0.29	0.40

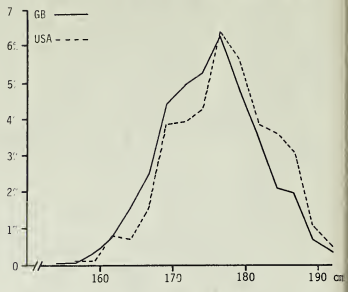
Table 2.2 Average height by age and social class

Social class		Age 16–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	All coded by social class
		Men										
I and II	cms	176.5	178.0	177.1	176.2	175.6	175.0	174.6	175.3	172.2	173.1	175.5
	Base	*112*	*108*	*134*	*153*	*146*	*131*	*110*	*110*	*92*	*86*	*1,183*
III (non-manual)	cms	174.8	178.3	176.1	176.2	174.2	175.2	176.3	174.0	171.1	170.2	174.9
	Base	*60*	*62*	*57*	*63*	*42*	*44*	*41*	*39*	*48*	*36*	*494*
III (manual)	cms	174.7	175.1	174.7	174.2	174.5	173.1	173.0	171.4	171.6	169.5	173.4
	Base	*176*	*210*	*251*	*218*	*190*	*187*	*173*	*172*	*187*	*118*	*1,866*
IV and V	cms	173.0	174.9	173.9	173.7	173.2	171.6	171.7	171.4	169.2	169.2	172.3
	Base	*94*	*113*	*87*	*95*	*82*	*78*	*71*	*100*	*98*	*66*	*886*
		Women										
I and II	cms	163.6	162.7	163.2	163.4	161.5	162.1	162.9	162.3	161.5	160.1	162.5
	Base	*111*	*117*	*146*	*159*	*132*	*152*	*101*	*109*	*87*	*77*	*1,195*
III (non-manual)	cms	163.1	163.5	163.0	162.2	162.2	162.6	160.7	160.0	159.7	159.2	161.6
	Base	*59*	*74*	*70*	*63*	*52*	*51*	*56*	*74*	*87*	*57*	*642*
III (manual)	cms	160.9	160.2	161.0	161.9	160.9	160.0	160.2	158.9	159.1	158.2	160.2
	Base	*209*	*209*	*212*	*208*	*205*	*171*	*157*	*186*	*165*	*128*	*1,856*
IV and V	cms	160.2	161.5	160.8	160.1	160.2	159.9	159.0	158.7	158.4	157.0	159.6
	Base	*85*	*121*	*102*	*94*	*80*	*75*	*80*	*96*	*111*	*90*	*937*

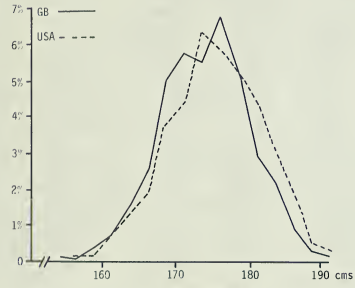
Figure 2.3 Height distributions of men by age: GB and USA compared



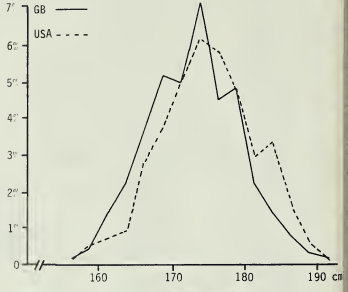
Men 18-24



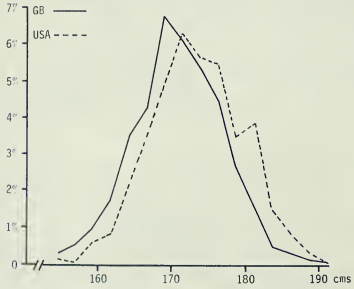
Men 25-34



Men 35-44

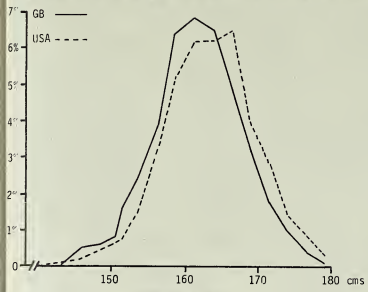


Men 45-54

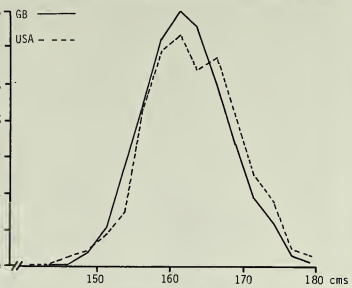


Men 55-64

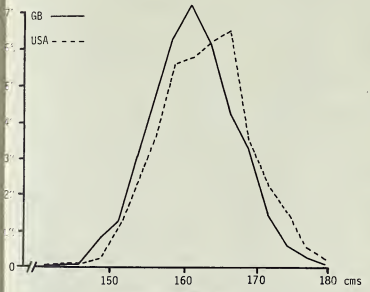
Figure 2.4 Height distributions of women by age: GB and USA compared



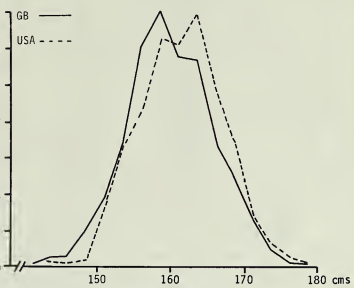
Women 18-24



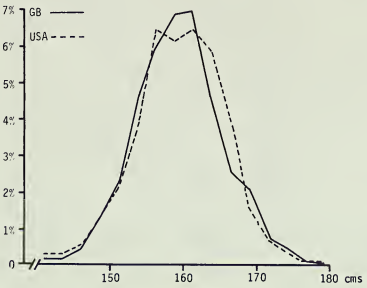
Women 25-34



Women 35-44



Women 45-54



Women 55-64

Table 2.3 Percentage distribution of height by region and sex

Height in cms	Region										
	Scotland	North	Yorks and Humberside	North West	East Midlands	West Midlands	East Anglia	Greater London	Rest of South East	South West	Wales
	%	%	%	%	%	%	%	%	%	%	%
	Men										
Up to 160.0	4	2	2	2	1	4	1	3	2	2	4
160.1–162.5	2	3	2	4	2	3	1	3	1	1	3
162.6–165.0	6	5	5	7	4	4	4	6	5	4	6
165.1–167.5	8	7	10	8	7	9	5	10	6	7	13
167.6–170.0	12	12	11	13	14	11	12	9	11	11	15
170.1–172.5	14	18	13	12	10	12	19	13	14	11	14
172.6–175.0	18	14	15	14	18	14	11	11	13	13	15
175.1–177.5	11	16	13	15	13	15	10	16	15	14	10
177.6–180.0	11	9	11	10	13	13	18	10	13	15	12
180.1–182.5	7	6	8	6	8	6	7	7	8	8	4
182.6–185.0	5	4	7	5	7	4	5	5	5	7	3
185.1–187.5	2	2	4	2	2	3	5	4	4	3	1
187.6–190.0	1	1	1	1	1	1	2	2	2	2	—
Over 190	0	1	1	0	1	2	1	1	2	2	0
Base	*434*	*269*	*420*	*556*	*357*	*454*	*142*	*589*	*871*	*384*	*226*
Average value	173.0	173.3	174.1	173.1	174.4	173.5	174.8	173.7	174.7	175.1	171.9
Standard error of average	0.47	0.59	0.52	0.43	0.42	0.37	0.19	0.47	0.27	0.50	0.63
	Women										
Up to 150.0	5	6	4	5	4	3	1	5	2	2	5
150.1–152.5	6	6	6	6	4	6	4	6	3	3	5
152.6–155.0	10	8	8	9	8	9	8	8	8	6	13
155.1–157.5	14	12	12	13	12	14	18	12	12	14	15
157.6–160.0	19	16	17	17	17	17	17	15	16	16	15
160.1–162.5	14	16	14	18	14	13	17	14	16	15	19
162.6–165.0	12	17	14	13	16	17	13	16	14	16	11
165.1–167.5	9	8	10	9	10	10	11	10	11	14	8
167.6–170.0	9	6	9	6	8	7	6	7	9	7	6
170.1–172.5	2	3	3	4	5	2	4	5	5	3	1
172.6–175.0	2	1	3	1	2	1	1	2	3	3	1
175.1–177.5	1	0	1	1	0	1	—	1	1	2	0
Over 177.5	1	—	0	0	—	0	—	1	0	1	1
Base	*492*	*293*	*453*	*622*	*380*	*489*	*147*	*670*	*955*	*419*	*255*
Average value	160.0	160.0	160.9	160.2	161.0	160.6	160.9	161.0	161.9	161.9	159.4
Standard error of average	0.37	0.24	0.43	0.30	0.25	0.23	0.36	0.40	0.31	0.38	0.40

though the women were the same as the British average.

Height of parents

Comparison with parental height inevitably suggests genetic influences on height, though the established link between good nutrition and growth also implies a nurture effect. But whatever the association between subject height and parental height, the survey was generally limited to the accuracy of the subject's recall.* Apart from those who had been adopted, or had never known their parents, people were asked:

"Can you tell me exactly how tall your father was (at his tallest)?"

The use of the word *exactly* was to discourage people from rounding off to a higher number like six foot, and the reference to *at his tallest* was to cover those people who could remember their father declining in height when he became old. The anwers were given in imperial units to the nearest inch and converted to metric units by computer, so there will be rounding errors in the figures which follow. There was also some tendency to rounding in the answers of survey subjects with even numbers of inches being given more often than odd numbers.

Ever since the nineteenth century work of Sir Francis Galton on the heights of fathers and sons, it has been generally accepted that the tallest fathers would tend to have sons shorter than themselves, and the shortest fathers would tend to have taller sons, as the sons 'regressed back to the mean'. This view has been supported by the survey findings (in Table 2.4) that although the average height of sons generally increases with the reported height of their fathers, sons of the fathers above current average height had a lower average height than their fathers. Correspondingly, sons of fathers below current average height were taller than their fathers on average. Similarly the heights of female

* In a minority of households fathers and mothers and adult children were measured together (14% of men were measured with their fathers and 13% of women were measured with their mothers). In such cases the actual measures were used in the tables which follow.

Table 2.4 Percentage distribution of heights of men/women by height of father/mother

Height of men (cms)	Height of father (reported or measured)												
	Up to 162.5	162.6 –165	165.1 –167.5	167.6 –170	170.1 –172.5	172.6 –175	175.1 –177.5	177.6 –180	180.1 –182.5	182.6 –185	185.1 –187.5	187.6 –190	Over 190
	%	%	%	%	%	%	%	%	%	%	%	%	%
Up to 162.5	19	10	10	5	3	3	2	2	1	1	—	—	7
162.6–165	11	13	14	7	7	3	2	3	2	2	2	1	5
165.1–167.5	12	17	19	14	9	6	5	4	3	3	3	2	2
167.6–170	11	18	10	17	17	14	8	7	5	5	8	5	7
170.1–172.5	17	11	15	15	20	14	12	11	9	10	8	9	11
172.6–175	11	10	11	13	16	18	19	14	12	11	16	10	12
175.1–177.5	8	11	9	12	12	13	18	19	18	11	15	11	9
177.6–180	3	6	8	7	8	14	15	14	20	21	15	14	10
180.1–182.5	4	2	2	6	4	7	10	11	11	13	7	10	4
182.6–185	3	2	1	3	2	4	5	9	8	13	13	9	5
185.1–187.5	—	0	—	1	2	3	3	4	7	6	5	10	15
187.6–190	—	1	0	—	1	1	0	2	2	3	5	10	2
Over 190	—	—	—	0	1	1	0	1	3	2	4	9	11
Base	*223*	*246*	*216*	*449*	*383*	*576*	*438*	*541*	*290*	*305*	*137*	*90*	*54*
Average height	168.7	170.0	169.5	171.8	172.3	174.2	175.1	176.1	177.6	177.7	178.0	179.8	177.4

Height of women (cms)	Height of mother (reported or measured)												
	Up to 150	150.1 –152.5	152.6 –155	155.1 –157.5	157.6 –160	160.1 –162.5	162.6 –165	165.1 –167.5	167.6 –170	170.1 –172.5	172.6 –175	175.1 –177.5	Over 177.5
	%	%	%	%	%	%	%	%	%	%	%	%	%
Up to 150	15	10	4	3	2	—	2	1	1	1	1	1	5
150.1–152.5	9	10	9	6	3	—	3	4	2	2	3	3	2
152.6–155	21	15	14	9	7	6	5	3	6	4	5	7	7
155.1–157.5	18	17	21	17	14	11	10	9	7	7	9	4	1
157.6–160	17	18	21	21	23	12	16	11	12	11	9	9	15
160.1–162.5	12	11	17	17	18	24	19	15	13	13	12	8	9
162.6–165	6	10	7	14	16	24	19	20	15	16	11	17	17
165.1–167.5	2	6	5	7	10	13	12	13	14	15	13	15	9
167.6–170	1	2	1	4	4	5	9	13	14	16	13	13	13
170.1–172.5	—	2	—	1	2	3	3	7	8	8	9	7	6
172.6–175	—	—	—	—	—	2	2	3	4	5	10	6	5
175.1–177.5	—	—	—	—	—	—	—	1	2	2	5	6	7
Over 177.5	—	0	—	—	—	—	—	—	1	—	1	4	2
Base	*184*	*403*	*315*	*706*	*619*	*69*†	*721*	*454*	*455*	*247*	*183*	*73*	*79*
Average height	155.6	157.5	157.8	159.6	160.3	162.1	161.8	163.2	163.8	164.2	164.8	165.1	164.0

† *Due to rounding at the conversion of reported height from imperial to metric none of the converted heights fitted into this range, which therefore contains only measured heights of mothers.*

subjects with mothers above current height were shorter than those of their mothers on average, whereas those women whose mothers were below average height had a higher average height than their mothers.

For the 11% who could not recall the height of their parents there was the much simpler question of whether they were taller than their father or mother. Clearly this measure must be less useful, depending as it does upon the memory of subjects who could not recall their parents' heights, and could not therefore be asked how much taller or shorter they were. The people involved tended to be older and correspondingly shorter on average than the rest of the sample.

Some 42% of the men in this group said they were taller than their fathers, 36% about the same, and only 22% said they were shorter. However the most common answer from this minority group of women, when asked about their mother's height, was 'about the same' (43%), with 34% saying they were shorter than their mothers and only 23% claiming to be taller. There is no simple explanation of why the women in this group should answer so differently about their mothers than the men did about their fathers. Table 2.5 shows that the men who said they were shorter than their fathers were shorter, on average, than the rest of the men answering the question. Similarly the women claiming to be shorter than their mothers had a lower average height than other women in the sub group receiving this question. However the men saying they were shorter than their fathers were relatively shorter within the minority answering this question, than were the women claiming to be shorter than their mothers. Thus one might infer that men were less ready to admit being shorter than their fathers, than women were ready to admit being shorter than their mothers. But it might equally be inferred that women remembered their mothers in more idealised terms than sons remembered their fathers and that the former were more likely to assume their parents was taller. Whatever the reason, much must be hidden within that vague group 'about the same' (which was a little larger among the women than it was among the men).

Table 2.5 Average height of those who could not recall parental height and were asked whether they were taller or shorter

	Men who could not recall father's height				Women who could not recall mother's height			
	All men	Subject thought he was:			All women	Subject thought she was:		
		Taller	About the same	Shorter		Taller	About the same	Shorter
Average height of subject in cms	172.2	175.3	170.2	169.6	159.2	161.8	159.0	157.8
Base	*518*	*216*	*187*	*116*	*565*	*131*	*240*	*194*

Birth order and height

A hypothesis on the nurture side of the nature-nurture debate is that firstborn children tend to be taller. It has been suggested that firstborn children have their mother's undivided attention and may as a result, fare better than their siblings in their early years, thus becoming taller. If this hypothesis were well founded it might be expected that it would be demonstrated most clearly in larger families where subsequent children might well compete for their mother's attention; so the results from small families (1 or 2 children) have been analysed separately in Table 2.6.

One way of investigating this hypothesis is to see whether firstborn subjects were taller than their brothers and sisters. Of course it was not possible to establish the actual height of siblings no longer living in the sampled households. Instead, all subjects were asked whether they had brothers or sisters who had survived to become adults. Those who did have adult siblings were then asked separately, whether they were taller than their brother(s), and their sister(s). The results in Table 2.6 show that the women who were firstborn children were no more likely to be tallest among siblings than were secondborn children. What the figures do suggest however is that women born as one of the later children in large families were less likely to be tallest in their family. Among the men there was a marginally higher proportion of 'tallest in family' among the firstborn from larger families, but the differences were so small they could have arisen from sampling error. As with the women, however, the later born men from the larger families were less likely to be the tallest sibling.

The main limitation of the foregoing analysis however, is that it excludes those who were 'only' children and therefore had no brothers or sisters. An alternative way of investigating the height of firstborn subjects is simply to compare their average height with the height of second or subsequently born children (now adults). Table 2.7 shows these averages but the differences to be found are not large enough for statistical significance in this sample and the original hypothesis that firstborn are taller has not been supported by the survey results. As in Table 2.6 the most interesting results seems to be that the later born offspring of larger families tend to be shorter, particularly the men.

Height compared with two health indicators

The survey questions included two simple indicators of general health, one short-term and one long-term. The long-term indicator was based on a question which has been used in the OPCS General Household Survey (GHS) for some years: *"Do you have any longstanding illness or disability or infirmity?"* Of course this was a rather broad question but the GHS shows[10] it to be a stable indicator from one year to the next.

Leaving aside the 16–19 year old age group, because so few of them had a longstanding health problem, average height of those men with a long-term complaint was lower, in every age group, than their healthier counterparts. However the results for women do not show the same clear trend. Women in their thirties with long-term illness were shorter on average than other women of that age, but in all the older age groups those with a longstanding complaint actually had a *higher* average height. In fact, the differences in average height between women with and without longstanding complaints was not statistically significant and could just be a statistical artefact but it is difficult to understand why height should only be associated with long-term health problems among the men.*

The second, short-term, health indicator was based on the question: *"During the* two weeks ending yesterday; *did you have to cut down on the things you usually do because of illness or injury?"* As with the long-term illness question, this indicator was inevitably rather broad, encompassing anything from a heavy cold to a serious illness which had started recently. The question also included 'injury', but in fact very few measured subjects were suffering in this way since people with such problems were normally left out of the survey because they could not adopt the posture required for height measurement.

With this health indicator the average heights of sufferers and non-sufferers (again leaving out the 16–19 year olds) were effectively the same (Table 2.8). Within the age groups, the differences between the average heights of sufferers and others were generally not significant; though the trend of what differences there were showed the younger age groups with short-term illness to be taller than those without short-term illness.

* Since social class has been measured by head of household's occupation and most male subjects were heads of household this result could reflect an association of both height and illness with class/occupation.

Table 2.6 Height in comparison with brothers and sisters, analysed by family size and birth order and sex

Height compared with siblings	Small families		Large families birth order						
	Firstborn	Second	1	2	3	4	5	6	7th or subsequent
	%	%	%	%	%	%	%	%	%
	Men								
Taller than brothers	38	38	33	29	32	27	28	19	27
Not taller	41	41	49	47	49	52	52	59	53
About the same	19	21	15	20	16	13	18	17	15
Can't recall	2	1	3	5	4	9	2	5	6
Base (all with adult brothers)	*262*	*284*	*504*	*528*	*561*	*293*	*196*	*122*	*108*
Taller than sisters	86	86	82	79	76	70	69	57	60
Not taller	6	6	9	9	13	15	17	27	26
About the same	7	8	9	10	9	13	10	14	12
Can't recall	1	0	1	2	2	2	4	2	2
Base (all with adult sisters)	*242*	*241*	*462*	*514*	*521*	*294*	*204*	*121*	*111*
	Women								
Taller than brothers	6	8	5	5	5	3	1	3	4
Not taller	83	83	82	84	84	86	87	83	80
About the same	7	7	7	6	6	7	5	5	6
Can't recall	4	1	6	6	6	4	7	8	11
Base (all with adult brothers)	*266*	*283*	*509*	*605*	*556*	*346*	*205*	*125*	*142*
Taller than sisters	40	41	26	28	29	28	19	17	18
Not taller	41	38	48	45	45	47	51	53	49
About the same	18	20	22	21	21	19	22	19	22
Can't recall	2	1	4	5	5	5	8	11	10
Base (all with adult sisters)	*253*	*264*	*547*	*583*	*545*	*339*	*213*	*123*	*138*

Birthplace

The survey also included a question on birthplace and this was used to code town of birth, for those born in major towns, or region of birth.† It has been found in some other studies that taller people are more likely to be geographically mobile and comparison of current residence with birthplace does offer a measure of such mobility. Of course this survey measure is subject to some limitations; there will be some who spent very little time in their town of birth so that their birthplace is of little relevance, and the survey did not seek information on length of residence in birthplace. Moreover, some people will have reported mobility from their birthplace which is not revealed by the broad regional coding used for this analysis.

Those born abroad are a further special sub group which, though identifiable, were too few to analyse separately.

Among the men, those still living in their region of birth (excluding those living in major towns) were not significantly different in average height (174cms) from the men who had moved to a different region (173.8cms). Similarly, the women still living in their region of birth (160.6cms) were not significantly shorter than those now living in another region (161cms).

However, the results for subjects living in the major towns provided some support for the predicted relationship between height and mobility. Women still living in the major town of their birth had an average height of 159.9cms compared with 160.9cms for their more mobile counterparts. Likewise, among the men who had moved from their major town of birth, average height was 174cms compared with 172.8cms among the men who had not moved. This report will not go on to analyse which towns or regions produced the tallest movers but the data have been stored on computer tape for anyone with the resources and interest to follow up this matter.

Female height: marriage and social class

Although it was not central to the purpose of this survey, the interviewer schedule did include one question on father's main occupation. Some 30 years ago, Illsley asked questions of a sample of women in Aberdeen, about to have their first baby, and reported[11] a tendency for tall women to raise their social class on marriage. This was based on their social class before marriage, classified by their father's occupation and their class at the time of interview based on their husband's occupation.*

† The survey sample did not in fact cover every major town, so those born in towns not included in the sample could not have been found (by the survey) to be still living in their town of birth. Nevertheless each of the major towns were included, or not, on a random basis and it seems reasonable to assume that the people still living in their major town of birth, in towns that were included, are likely to be representative of their counterparts in towns not within the sample.

* Apart from the fact that many of the married women in Illsley's sample had not worked since marriage, a social class classification based on the women's own occupation would have concentrated the vast majority of them in only two classes, due to the narrow range of women's occupations and the male bias in the occupation – based social class classification. Illsley was able to ask the young women in his sample about their father's occupation during most of their school years, but for the older women in the OPCS survey this was felt to be too difficult a test of memory and the OPCS question was phrased in terms of father's occupation for most of his working life.

Table 2.7 Average height by family size and birth order

	Small families		Larger families: birth order						
	Firstborn	Second	1	2	3	4	5	6	7th or subsequent
Average height of men in cms	174.4	174.9	174.2	173.8	173.8	172.0	173.0	171.8	171.6
Base	*683*	*518*	*640*	*641*	*651*	*330*	*219*	*72*	*136*
Average height of women in cms	161.5	161.8	160.9	160.5	160.6	160.7	159.2	159.2	159.0
Base	*717*	*537*	*717*	*755*	*669*	*378*	*223*	*132*	*171*

Table 2.8 Average height of those with and without long-term complaints or short-term illnesses

Health indicators		Men aged:					All men	Women aged:					All women
		20–29	30–39	40–49	50–59	60–64	20–64	20–29	30–39	40–49	50–59	60–64	20–64
Long-term illness or disability*													
Yes	cms	174.8	173.8	172.5	171.6	169.6	172.3	161.6	161.2	161.3	159.8	158.9	160.5
	Base	*117*	*166*	*192*	*295*	*150*	*920*	*114*	*184*	*201*	*343*	*166*	*1,007*
No	cms	175.7	174.9	173.9	172.0	171.0	174.1	161.7	161.7	160.8	159.5	158.3	160.9
	Base	*959*	*851*	*672*	*587*	*187*	*3,256*	*1,034*	*908*	*731*	*670*	*253*	*3,596*
*Short-term illness**													
Yes	cms	176.0	175.2	174.2	171.5	169.8	173.6	161.4	161.9	161.4	160.3	157.8	160.8
	Base	*69*	*65*	*63*	*78*	*35*	*310*	*72*	*81*	*70*	*117*	*38*	*378*
No	cms	175.6	174.7	173.5	171.9	170.4	173.7	161.7	161.6	160.8	159.5	158.6	160.7
	Base	*1,009*	*952*	*802*	*803*	*302*	*3,869*	*1,068*	*1,010*	*860*	*899*	*381*	*4,218*

* *See text for definition*

But if the same comparisons as Illsley are to be made from the present survey, the limitations of both studies for this purpose have to be borne in mind, even when class is measured only by occupation of father and husband. One problem is that some people only attain their highest status occupation later in life, so that their social class may be different at different stages of their married life. Moreover, the growth in the number of non-manual jobs since the Second World War has encouraged upward mobility between generations if not always within generations.

To avoid these methodological problems one should ideally look separately at cohorts of women married in the same time period and assess their social class at a common point in their married life; probably just after their marriage. However, in the context of the present survey, the only social class measure available was based on husband's current occupation and the best approximation to marriage at a common period of time, and common stage of the female life cycle, was to identify and analyse groups of women of the same age. (Indeed it may be argued that the analysis should only be undertaken for the younger members of the sample if the results are to be comparable with the mothers in the Illsley study.)

In Figure 2.5 the comparison of current social class with class before marriage is shown separately for different heights of married women within different age groups. Of course, some mobility was downwards and the net upward movement is summarised by subtracting the percentage of downwardly mobile from the percentage of upwardly mobile.

In the youngest age group of married women (aged under 30) those of average height or slightly above (160–164.9cms) were most likely to have attained a higher social class than they had before marriage. The taller group (165 cms and above) among the under thirties showed less upward mobility, but this group contained a higher proportion of middle class women to start with.*

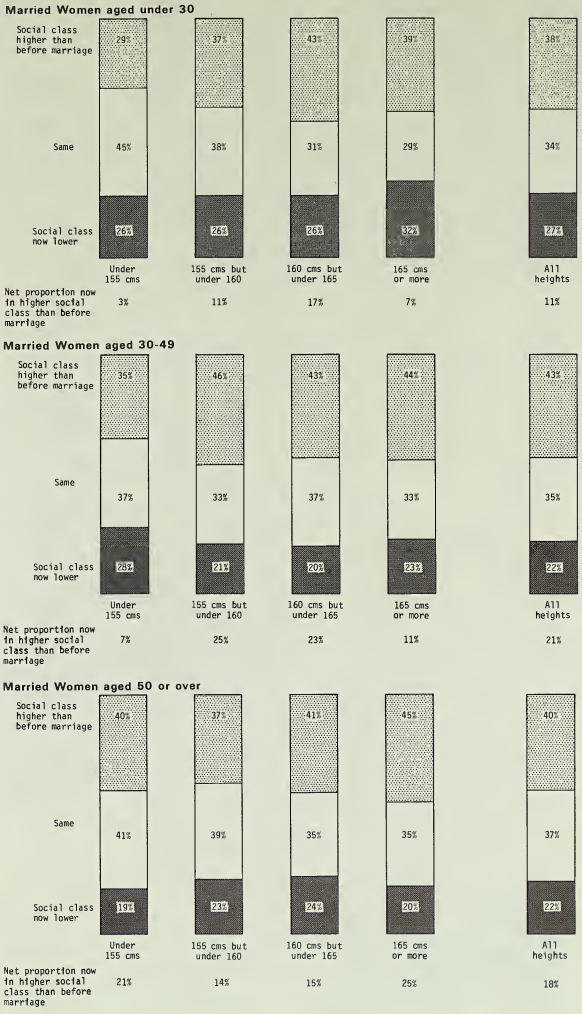
Furthermore for those in the top social class any mobility could only be downwards and this can be seen in the above proportion who were downwardly mobile in the tallest group. What is most noticeable however is the non-mobility of the shortest married women (less than 155cms tall) under 30, 45% of whom had remained in the same social class after marriage.

Looking at the 30–49 age group, most of these women would have been married for over ten years, and the complication of social mobility during the married period starts to arise. As with the youngest age group, the shortest women were least likely to be in a higher social class when interviewed than before marriage.

The married women in their fifties and sixties were the group which had longest to change their social class during their marriage but they were also the ones whose husbands had started their careers before the expansion of 'white-collar' occupations. In this age group the shortest height group (less than 155cms)

* See Table 2.2 which shows that women in Social Classes I, II and III (non-manual) are taller than women in the lower social classes.

Figure 2.5 Current social class of married women compared with social class before marriage shown by age and height



accounted for a much larger proportion of the total because older people tended to be shorter (and had, to some extent, lost height since their younger days when they were first married). Thus within this age group the women who were over 165cms really did stand out as much taller than their peers. The proportion of this tall group whose social class had risen since the time they were unmarried was indeed higher than among the shorter women of that age.

Overall then, the survey results, particularly those for the youngest age group which is probably the most comparable with the Illsley sample, seem to show that the shortest women were least likely to raise their social class through marriage and that, to a lesser extent, the tallest were most likely to raise their social class in this way.

Yet the difficulties in taking account of other possible explanatory factors do limit the confidence which can be placed in any theory based on these results. As Illsley concluded, it is not easy "to see why tallness should be associated with marriage into the upper occupation levels".

3 Weight distribution of the population

This chapter shows the weight distribution of the adult population aged 16–64 and cautions that this information alone is no guide to the prevalence of obesity.

Weight by age

The survey measured the weight of subjects in kilogrammes to the nearest 0.5 kilos after making an allowance for the weight of clothing. Of course, weight can vary from day to day or even at different times within the same day and since the survey took only one measure, the results must be treated as a 'typical' value of a slightly unstable variable. However, that limitation is accepted for many clinical purposes and is thought to be acceptable for the purposes of this study.

The average weight of men aged 16–64, at the time of the survey, was 73.6 kilos (11st 8lbs) and the female average was 62.0 kilos (9st 11lbs).* Figure 3.1 shows the weight distribution† and it is clear that for both men and women that distribution is positively skewed, which means that there were more people below average weight than were above average weight. The modal, or most common, weight for men was 73.0 kilos while the most common weight for women was 60.5 kilos.

* If the under 20 age group (which will contain a number of subjects who are still growing) are omitted, the average weights increase marginally to 74.6 kilos (11st 10lbs) for men and 62.5 kilos (9st 12lbs) for women, though these increases are not statistically significant. Furthermore, since the scales only weighed to the nearest 0.5 kilos this implies a rounding error which is not apparent in the average quoted to the nearest 0.1 kilos.

† These graphs are only for illustrative purposes and have been smoothed to plotted points by hand.

Table 3.1 Percentage distribution of weight by age and sex

Weight in kilos	16–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64
	%	%	%	%	%	%	%	%	%	%
	Men									
Up to 45	1	0	0	0	0	—	0	0	0	1
45.5–50	2	1	1	1	0	—	0	0	0	2
50.5–55	10	2	2	1	2	1	1	2	4	2
55.5–60	17	10	8	5	4	4	4	5	8	7
60.5–65	23	19	13	11	12	12	8	7	11	10
65.5–70	21	19	17	19	13	16	14	20	17	14
70.5–75	11	18	21	17	20	17	20	19	18	18
75.5–80	6	12	19	17	18	16	14	18	15	17
80.5–85	4	9	9	12	12	15	18	12	11	15
85.5–90	2	5	6	7	8	10	10	8	8	9
90.5–95	1	2	2	5	5	5	6	5	4	2
95.5–100	1	2	1	2	2	2	2	2	2	2
Over 100	0	1	2	3	3	3	3	3	2	2
Base	*481*	*518*	*539*	*523*	*459*	*438*	*401*	*424*	*441*	*326*
Average value	65.6	71.4	73.0	74.9	75.7	76.4	77.4	75.2	73.8	74.2
Median value	64.5	70.0	73.0	74.5	74.5	75.5	76.5	74.5	73.0	74.0
Standard error of average	0.53	0.51	0.49	0.50	0.63	0.52	0.64	0.59	0.56	0.81
	Women									
Up to 45	6	5	3	2	2	2	2	3	3	3
45.5–50	15	12	9	9	6	6	5	7	5	6
50.5–55	27	18	24	19	21	14	15	11	12	14
55.5–60	21	23	22	21	22	22	18	20	18	17
60.5–65	16	21	18	20	19	18	21	19	21	16
65.5–70	6	9	11	15	10	17	15	13	12	18
70.5–75	4	7	4	7	8	9	9	10	15	9
75.5–80	2	3	3	4	5	5	7	6	6	8
80.5–85	1	1	2	2	3	2	3	4	3	4
85.5–90	1	1	1	1	1	3	2	3	3	3
Over 90	1	0	2	1	3	3	3	4	2	3
Base	*499*	*548*	*560*	*561*	*495*	*486*	*419*	*498*	*497*	*414*
Average value	57.1	59.2	59.9	61.2	62.2	63.9	64.3	64.6	64.7	64.5
Median value	55.5	58.5	58.0	60.0	60.0	61.5	62.5	62.5	63.0	63.5
Standard error of average	0.39	0.48	0.44	0.39	0.43	0.63	0.49	0.63	0.49	0.67

Figure 3.1 Weight distribution

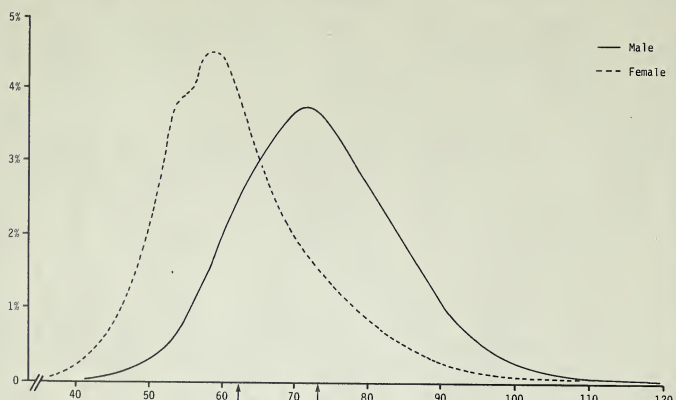


Table 3.1 shows the distribution of weight by age but at this point it is worth anticipating the content of Chapter 4 which shows the weight is correlated with height. Since taller people in general weigh more than shorter people, the weight distributions are bound to be influenced by height distributions. Thus the weight distribution by age will be influenced by the fact that average height is lower for the older age groups. Any tendency for older people to put on weight is therefore masked at least partially by their tendency to be shorter. In spite of this important limitation, the results still show a general increase in weight with age among men up to 50 but beyond that age average weight declines (following a considerable drop in average height as shown in Table 3.1). Female average weight increases with age up to age 60, in spite of a decline in average height with age, which certainly indicate a tendency towards overweight in the older age groups even before height is taken into account.

When these results are compared with those for the USA, the average weight of white American men in 1970–74 was 78 kilos (4.4 kilos heavier than in GB) and for white American women it was 64.9 kilos (2.9 kilos heavier than in GB). Figures 3.2 and 3.3 compare the weight distribution by age for Britain and the USA on the same basis as the height comparisons[a] and it is evident that Americans tend to weigh more, on average, in all age groups. Moreover the spread of the weight distribution tends to be wider for the Americans than for the British implying a greater proportion of very heavy people. This can be illustrated by comparison of the 95th percentile ie that point in the weight distribution above which the heaviest 5% of the population are situated. Table 3.2 shows that for all age groups the 95th percentile of weight was at least 7 kilos greater for American men and 6 kilos greater for American women than their British equivalents which is more than height differences alone could explain.§

[a] See explanation in Chapter 2.

§ See Chapter 4.

Table 3.2 95th percentiles* of the weight distribution by age: GB and USA

	95th percentile of weight distribution (kilos)	
	Great Britain	USA
Men		
18–24	87.5	100.7
25–34	93.9	105.7
35–44	94.3	102.1
45–54	95.2	102.1
55–64	93.6	100.7
All ages 18–64	94.5	102.1
Women		
18–24	76.3	82.1
25–34	79.9	91.6
35–44	86.7	97.5
45–54	86.7	96.6
55–64	85.5	92.1
All ages 18–64	83.4	93.2

* *For the British results this has been calculated from grouped data. For the USA results the figure has been calculated from ungrouped data but has been quoted from published reports, where it is rounded to the nearest pound, from which the metric equivalent has been calculated.*

Table 3.3 Average weight by age and social class

Social class		Men						Women					
		16–19	20–29	30–39	40–49	50–59	60–64	16–19	20–29	30–39	40–49	50–59	60–64
I and II	kilos	65.6	72.7	75.1	76.8	76.3	77.6	57.5	59.4	60.3	62.3	65.6	63.9
	Base	*108*	*237*	*287*	*237*	*193*	*81*	*108*	*249*	*280*	*243*	*192*	*76*
III (non-manual)	kilos	64.6	72.5	74.3	76.9	74.3	73.7	57.1	59.7	61.1	63.6	62.5	64.3
	Base	*60*	*115*	*101*	*80*	*84*	*36*	*59*	*137*	*110*	*103*	*154*	*54*
III (manual)	kilos	67.1	73.3	76.0	77.5	75.1	72.8	57.2	59.6	62.3	64.8	64.6	65.1
	Base	*167*	*437*	*385*	*337*	*345*	*110*	*193*	*398*	*391*	*311*	*330*	*122*
IV and V	kilos	64.2	70.4	74.7	75.4	72.0	72.8	56.6	59.8	62.8	64.7	64.5	65.9
	Base	*90*	*195*	*170*	*144*	*182*	*62*	*81*	*219*	*167*	*147*	*192*	*85*

Weight by social class

Table 3.3 shows average weight by class, within age groups and among men under 50 it seems that Social Class III (manual) tend to be the heaviest, though they are not the tallest. Otherwise weight is highest in the higher social classes where greater height is probably the principal cause. Women aged 30–49 and those over 60 tended to be heaviest in the lower social classes even though height was less. But in the other age groups there was no clear class effect on female weight.

Weight by region

Although like other measured weight tables, they are not an adequate guide to obesity levels, regional weight distributions and averages are shown in Table 3.4 to complete the picture. Regional differences in average weight showed people in the South West to be the heaviest, but as was shown in the previous chapter, they were also the tallest. The average weights of Scottish residents were lower than the average for Britain as a whole, but this is also explicable, to a considerable extent, by their lower than average heights. East Midlands and East Anglian women had a slightly higher than average weight although they tended to be the same height as the rest of the population.

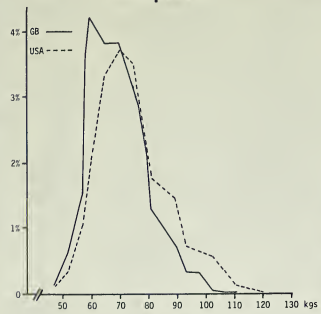
Weight change since age 21

In order to gauge the extent of weight increase in adult life it was necessary to ask subjects about their weight when younger. The age of 21 was chosen as a baseline because it was thought that most people would be more or less fully grown by then and that 21 was an important threshold in their lives which they might recall better than some other age. To allow time for weight change to take place, only subjects over age 30 were asked about their weight at 21 and comparisons with current

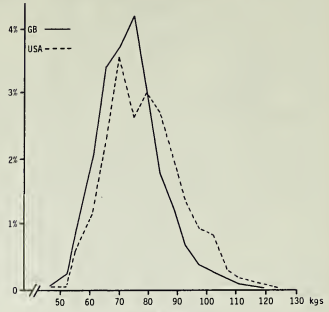
Table 3.4 Percentage distribution of weight by region and sex

Weight in kilos	Region										
	Scotland	North	Yorks and Humberside	North West	East Midlands	West Midlands	East Anglia	Greater London	Rest of South East	South West	Wales
	%	%	%	%	%	%	%	%	%	%	%
	Men										
Up to 45	1	—	0	0	0	1	—	0	0	—	0
45.5–50	1	1	1	1	1	1	—	1	1	1	1
50.5–55	3	3	3	3	2	2	1	3	3	2	3
55.5–60	6	9	7	8	9	7	9	7	7	7	9
60.5–65	13	10	12	15	10	14	11	16	12	11	12
65.5–70	20	19	16	16	14	18	14	18	19	16	17
70.5–75	18	18	18	18	17	18	21	14	19	18	21
75.5–80	16	14	14	15	16	15	13	15	16	17	12
80.5–85	10	13	12	11	14	9	10	13	11	13	13
85.5–90	7	6	7	6	9	7	13	6	7	6	8
90.5–95	3	3	3	3	4	5	3	4	4	4	3
95.5–100	1	1	3	2	2	2	2	2	1	3	2
Over 100	1	3	4	3	2	2	4	3	1	2	1
Base	*402*	*265*	*372*	*554*	*335*	*454*	*136*	*560*	*872*	*387*	*220*
Average value	72.6	73.5	74.4	73.3	74.5	73.2	75.5	73.5	73.3	74.6	73.3
	Women										
Up to 45	3	4	4	3	3	2	1	5	3	2	3
45.5–50	8	9	9	9	9	7	9	10	7	7	9
50.5–55	21	17	16	21	15	15	12	19	19	13	20
55.5–60	24	20	21	20	21	24	25	16	20	22	19
60.5–65	22	20	17	18	19	19	16	18	21	18	20
65.5–70	10	13	13	13	9	13	13	13	12	13	14
70.5–75	5	8	9	5	11	7	9	9	8	12	7
75.5–80	3	4	6	4	5	5	8	5	4	6	6
80.5–85	2	3	3	3	3	3	3	2	3	3	0
85.5–90	2	1	2	2	2	3	1	1	2	3	1
Over 90	1	2	2	2	4	1	4	3	2	3	2
Base	*457*	*288*	*407*	*620*	*361*	*483*	*140*	*626*	*944*	*420*	*249*
Average weight	60.3	61.4	62.2	61.2	63.4	62.2	63.0	62.0	62.1	63.9	61.4

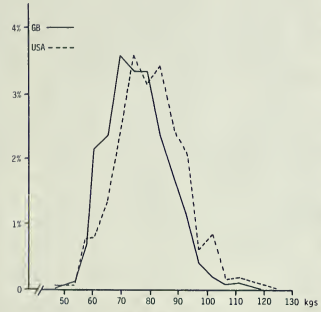
Figure 3.2 Weight distributions of men by age: GB and USA compared



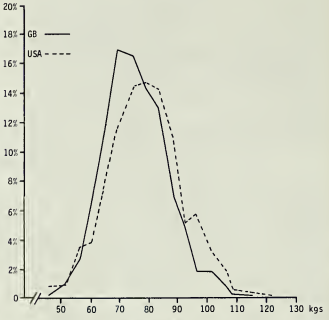
Men 18-24



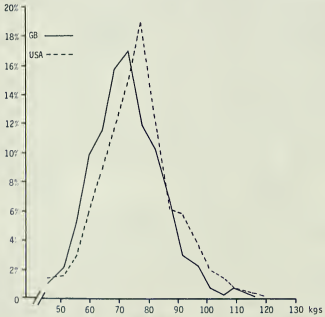
Men 25-34



Men 35-44

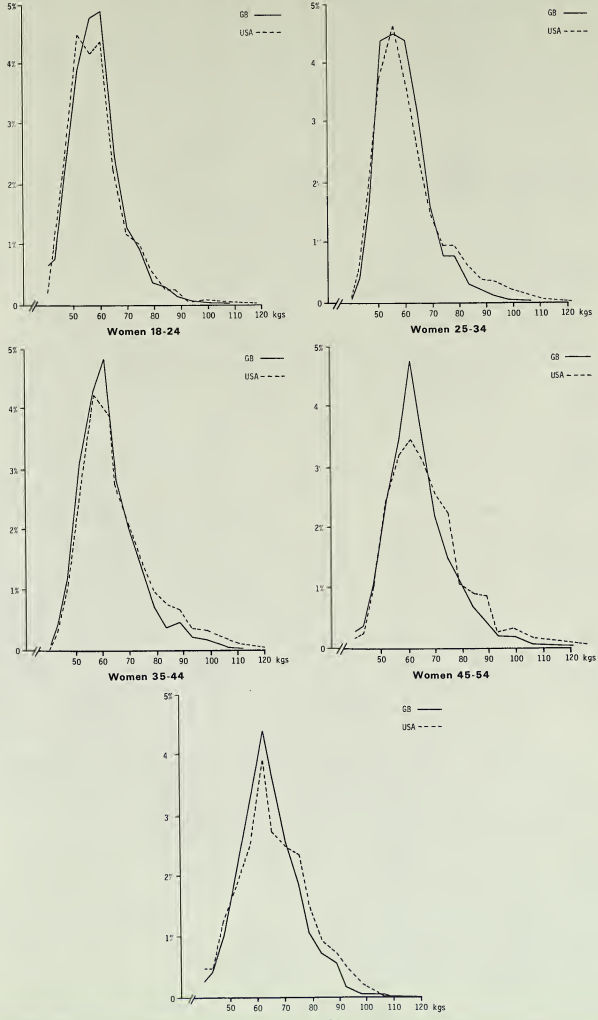


Men 45-54



Men 55-64

Figure 3.3 Weight distributions of women by age: GB and USA compared



weight were therefore only made for this older age group. Not surprisingly some people said they could not remember their weight at 21, but of the 85% of men and 86% of women who could remember, more than three quarters weighed more at the time of the survey than in their younger days. The extent of such weight change however, can only be approximated by this method, relying as it does on memory and freedom from an idealised recollection of the past.

The majority of women under 50 kilos and men under 60 kilos had actually lost weight since age 21 (see Table 3.5). But the vast majority of women over 60 kilos and men over 75 kilos had gained weight with the heaviest by and large, having put on the most weight. This suggests that most of the heavier subjects in the survey had acquired their excess weight in adult life – a point which will be taken up again in Chapter 4.

Table 3.5 Weight change among men and women since age 21 by current weight

Weight change since age 21	Current weight of men aged over 30 (in kilos)											All who could recall weight at 21
	Up to 55	55.5 –60	60.5 –65	65.5 –70	70.5 –75	75.5 –80	80.5 –85	85.5 –90	90.5 –95	95.5 –100	Over 100	
	%	%	%	%	%	%	%	%	%	%	%	%
Weight loss												
Over 20 kilos	4	1	1	0	1	1	1	2	1	—	—	1
Over 16–20	2	2	0	0	0	1	—	—	—	—	—	0
Over 12–16	10	5	1	1	1	0	0	—	2	—	1	1
Over 8–12	20	8	3	2	3	1	0	0	3	2	3	3
Over 4–8	24	17	10	7	3	2	2	1	2	—	3	5
Up to 4	25	27	28	17	8	7	4	1	4	2	2	11
No change	2	1	6	4	2	1	0	2	2	—	—	2
Weight gain												
Up to 4 kilos	10	23	32	28	20	14	10	5	5	8	6	18
Over 4–8	—	11	13	21	32	23	15	11	9	12	4	19
Over 8–12	2	5	4	12	16	24	24	18	7	10	4	15
Over 12–16	—	1	1	5	10	21	19	20	18	20	9	12
Over 16–20	2	—	1	1	3	5	17	19	19	14	8	7
Over 20	—	—	0	1	1	2	8	21	30	33	59	7
Base	*58*	*133*	*260*	*418*	*467*	*404*	*331*	*214*	*116*	*51*	*70*	*2,521*
Average weight change	−6.0	−1.8	+0.5	+2.8	+5.1	+7.8	+11.0	+14.3	+14.6	+16.3	+21.9	+6.7

	Current weight of women aged over 30 (in kilos)											All who could recall weight at 21
	Up to 45	45.5 –50	50.5 –55	55.5 –60	60.5 –65	65.5 –70	70.5 –75	75.5 –80	80.5 –85	85.5 –90	Over 90	
	%	%	%	%	%	%	%	%	%	%	%	%
Weight loss												
Over 20 kilos	5	—	1	0	0	1	1	—	—	1	—	1
Over 16–20	4	1	0	0	—	—	1	—	1	—	—	0
Over 12–16	5	3	1	1	0	1	—	1	—	—	1	1
Over 8–12	11	5	4	3	3	2	0	—	1	2	—	3
Over 4–8	18	16	6	4	3	2	2	2	1	—	—	4
Up to 4	32	26	17	15	6	4	2	1	—	—	2	10
No change	3	3	4	2	2	1	1	1	—	—	—	2
Weight gain												
Up to 4 kilos	21	30	35	21	19	12	4	2	1	3	3	18
Over 4–8	1	13	24	31	27	20	16	6	9	1	—	21
Over 8–12	—	2	9	14	21	26	21	13	6	4	5	15
Over 12–16	—	—	1	7	12	18	22	20	11	5	4	10
Over 16–20	—	—	0	1	5	9	14	18	17	8	2	5
Over 20	—	—	—	0	2	4	16	37	54	76	82	10
Base	*66*	*189*	*453*	*577*	*572*	*396*	*264*	*157*	*91*	*62*	*70*	*2,897*
Average weight change	−4.7	−0.8	+1.8	+3.7	+6.4	+8.3	+12.0	+17.1	+20.2	+23.5	+31.4	+7.2

4 Weight for height

This chapter examines the relationship of weight to height and analyses their association by use of regression. Different indices of weight for height are examined and the Body Mass Index (BMI) is found to be most useful. The BMI values for the survey population are shown as distributions and averages analysed by demographic and allied variables.

Distribution of height by weight

It has already been pointed out within this report that height and weight are related and that simple tables of measured weight are a poor indicator of obesity. Table 4.1 shows how average weight increases with height for the adult population. Just under 1 in 7 of the shortest men (up to 160cms) weighed *over* 70 kilos while only 1 in 7 of the tallest (over 187.5cms) were *under* 70 kilos. Among women aged 16–64 the spread of weights in given height bands was a little broader but the same general picture was evident, with the largest proportions of heavier people in the tallest groups.

However, as height decreases in successive age groups while, at least for women, weight on average increases with age, the relationship between height and weight should ideally be examined separately for each age group (as in Table 4.2). Since the 16–19 age group contained a number of individuals who were still growing it was kept apart from the rest, even though the sample size was quite small and some averages for this group were consequently less reliable.

Although the general tendency to increase weight with age means that the modal weights for each height band are greater in the older age groups, these tables (4.3–

Table 4.1 Percentage distribution of weight at each height; all males and females aged 16–64

Weight in kilos	Height of men (cms)												
	Up to 160.0	160.1 –162.5	162.6 –165.0	165.1 –167.5	167.6 –170.0	170.1 –172.5	172.6 –175.0	175.1 –177.5	177.6 –180.0	180.1 –182.5	182.6 –185.0	185.1 –187.5	Over 187.5
	%	%	%	%	%	%	%	%	%	%	%	%	%
Up to 45	8	4	1	—	0	0	—	—	—	—	—	—	—
45.5–50	8	4	3	1	1	0	0	—	—	—	—	—	—
50.5–55	13	9	9	6	4	3	2	1	0	0	1	—	—
55.5–60	20	23	15	13	9	9	7	4	3	2	3	1	1
60.5–65	27	20	22	17	16	14	13	11	10	8	7	5	1
65.5–70	12	21	21	23	22	19	17	19	15	14	8	7	12
70.5–75	8	10	15	18	16	21	20	18	19	16	20	15	11
75.5–80	2	4	8	9	15	16	16	18	19	17	20	11	19
80.5–85	2	4	4	6	10	9	12	13	14	17	18	24	13
85.5–90	1	1	1	4	5	4	7	8	10	12	12	15	12
90.5–95	—	1	1	2	2	3	3	4	4	7	5	11	15
95.5–100	—	—	—	1	1	1	2	3	2	3	3	3	5
Over 100 kilos	—	—	—	1	0	1	2	2	4	3	5	8	11
Base	*107*	*102*	*235*	*347*	*524*	*598*	*626*	*631*	*528*	*321*	*225*	*133*	*110*
Average weight	60.0	63.0	65.7	69.0	70.7	71.8	73.7	75.5	77.0	78.7	79.2	82.2	85.0

Weight in kilos	Height of women (cms)											
	Up to 150.0	150.1 –152.5	152.6 –155.0	155.1 –157.5	157.6 –160.0	160.1 –162.5	162.6 –165.0	165.1 –167.5	167.6 –170.0	170.1 –172.5	172.6 –175.0	Over 175.0
	%	%	%	%	%	%	%	%	%	%	%	%
Up to 45	17	12	8	4	2	1	0	1	—	—	—	—
45.5–50	22	17	16	13	8	7	5	3	2	2	—	—
50.5–55	20	22	25	20	23	21	14	13	11	5	3	—
55.5–60	20	16	18	23	22	21	23	21	19	15	16	9
60.5–65	8	14	15	16	17	22	22	23	20	23	18	27
65.5–70	5	8	8	10	11	12	15	15	16	21	20	18
70.5–75	3	7	4	6	7	7	9	11	11	11	19	15
75.5–80	4	3	3	5	4	4	5	5	5	11	9	8
80.5–85	1	1	1	1	3	2	3	3	3	5	6	8
85.5–90	1	—	1	1	3	2	2	3	3	4	4	3
Over 90 kilos	—	1	1	1	1	2	2	3	4	2	4	11
Base	*172*	*235*	*417*	*643*	*804*	*761*	*724*	*492*	*359*	*183*	*94*	*57*
Average weight	54.5	56.9	57.6	59.7	61.3	61.8	63.8	64.9	65.7	68.1	69.7	72.5

Table 4.2 Percentage distribution of weight at each height by sex

(a) Age 16–19

Weight in kilos	Height of men (cms)						
	Up to –167.5	167.6 –170.0	170.1 –172.5	172.6 –175.0	175.1 –177.5	177.6 –180.0	Over 180
	%	%	%	%	%	%	%
Up to 45	6	—	—	—	—	—	—
45.5–50	13	4	1	2	—	—	—
50.5–55	28	16	15	12	2	3	2
55.5–60	26	28	23	24	11	12	7
60.5–65	9	29	27	29	34	15	17
65.5–70	8	15	18	14	31	27	29
70.5–75	4	3	5	9	12	21	18
75.5–80	2	2	8	3	5	9	10
80.5–85	2	—	4	6	2	6	7
85.5–90	2	2	—	—	—	5	5
90.5–95	—	—	—	2	3	—	4
95.5–100	—	—	—	—	1	—	2
Over 100	—	—	—	—	—	2	—
*Base**	*58*	*52*	*71*	*62*	*84*	*64*	*87*
Average weight	57.6	61.1	63.3	63.8	67.0	69.9	71.4

Weight in kilos	Height of women (cms)						
	Up to –155.0	155.1 –157.5	157.6 –160.0	160.1 –162.5	162.6 –165.0	165.1 –167.5	Over 167.5
	%	%	%	%	%	%	%
Up to 45	32	15	3	1	—	2	—
45.5–50	32	33	15	11	12	6	5
50.5–55	15	20	37	39	28	28	17
55.5–60	10	15	26	21	21	26	21
60.5–65	5	14	11	19	16	22	25
65.5–70	2	—	1	5	9	9	14
70.5–75	1	—	5	2	8	3	7
75.5–80	2	2	2	1	5	2	2
80.5–85	—	2	—	1	—	—	5
85.5–90	—	—	1	—	1	2	2
Over 90	—	—	—	—	1	—	2
*Base**	*57*	*52*	*95*	*84*	*76*	*55*	*80*
Average weight	49.5	52.9	56.1	56.6	60.1	58.9	63.2

(b) Age 20–29

Weight in kilos	Height of men (cms)								
	Up to –165.0	165.1 –167.5	167.6 –170.0	170.1 –172.5	172.6 –175.0	175.1 –177.5	177.6 –180.0	180.1 –182.5	Over 182.5
	%	%	%	%	%	%	%	%	%
Up to 45	3	—	—	—	—	—	—	—	—
45.5–50	7	—	1	1	—	—	—	—	—
50.5–55	13	8	6	1	—	—	—	—	—
55.5–60	28	21	8	12	12	4	3	4	2
60.5–65	18	25	22	23	20	14	13	8	7
65.5–70	19	17	22	25	19	21	18	15	10
70.5–75	10	17	11	19	17	26	24	26	18
75.5–80	1	5	21	14	14	15	17	21	24
80.5–85	2	3	7	3	8	9	8	14	18
85.5–90	—	4	1	1	5	4	10	8	10
90.5–95	—	2	2	1	1	2	3	2	5
95.5–100	—	—	1	—	2	2	3	3	2
Over 100	—	—	—	—	1	2	2	—	5
Base	*72*	*74*	*86*	*120*	*144*	*136*	*142*	*101*	*177*
Average weight	61.0	65.8	69.7	68.2	71.2	73.7	75.2	75.6	79.1

* *NB Small base numbers make estimates of small or zero cells rather unreliable.*

Table 4.2 – *continued*

(b) Age 20–29

Weight in kilos	Height of women (cms)								
	Up to 152.5	152.6 –155.0	155.1 –157.5	157.6 –160.0	160.1 –162.5	162.6 –165.0	165.1 –167.5	167.6 –170.0	Over 170.0
	%	%	%	%	%	%	%	%	%
Up to 45	19	14	7	4	1	—	—	—	—
45.5–50	25	28	19	8	9	8	5	1	1
50.5–55	25	20	24	32	25	21	14	15	6
55.5–60	8	16	22	22	28	27	24	30	16
60.5–65	8	12	11	16	18	23	29	28	30
65.5–70	6	3	9	11	7	9	11	10	23
70.5–75	5	3	3	2	5	7	9	5	10
75.5–80	3	—	1	2	6	1	3	5	7
80.5–85	1	1	2	2	—	4	2	1	2
85.5–90	—	—	2	1	1	1	2	3	3
Over 90	—	3	1	—	1	—	2	3	2
Base	*80*	*73*	*125*	*161*	*174*	*175*	*134*	*93*	*90*
Average weight	53.3	54.6	56.8	58.2	59.4	60.3	62.5	62.8	66.2

(c) Age 30–39

Weight in kilos	Height of men (cms)								
	Up to 165.0	165.1 –167.5	167.6 –170.0	170.1 –172.5	172.6 –175.0	175.1 –177.5	177.6 –180.0	180.1 –182.5	Over 182.5
	%	%	%	%	%	%	%	%	%
Up to 45	3	—	1	—	—	—	—	—	—
45.5–50	6	2	1	—	—	—	—	—	—
50.5–55	5	8	3	1	—	1	—	—	1
55.5–60	18	13	6	5	4	2	3	—	1
60.5–65	33	11	19	10	13	8	11	7	2
65.5–70	18	30	23	18	20	17	13	16	5
70.5–75	8	15	21	30	23	19	15	12	15
75.5–80	3	11	14	18	17	24	23	13	17
80.5–85	1	5	8	8	9	16	15	22	19
85.5–90	1	—	1	4	7	8	7	17	17
90.5–95	4	2	3	5	2	2	7	8	13
95.5–100	—	2	—	1	2	3	2	1	4
Over 100	—	2	1	2	3	2	5	4	6
Base	*72*	*52*	*109*	*120*	*124*	*187*	*122*	*70*	*117*
Average weight	64.0	69.0	70.1	74.2	75.0	76.6	78.2	80.0	83.0

Weight in kilos	Height of women (cms)								
	Up to 152.5	152.6 –155.0	155.1 –157.5	157.6 –160.0	160.1 –162.5	162.6 –165.0	165.1 –167.5	167.6 –170.0	Over 170.0
	%	%	%	%	%	%	%	%	%
Up to 45	13	9	1	1	—	1	—	—	—
45.5–50	20	16	16	12	6	5	1	1	—
50.5–55	27	37	27	25	20	15	15	11	5
55.5–60	18	16	22	19	20	28	29	16	12
60.5–65	11	13	15	17	26	18	20	30	22
65.5–70	6	4	7	12	12	13	12	24	24
70.5–75	3	—	4	7	6	8	11	8	18
75.5–80	—	5	4	3	5	6	6	2	6
80.5–85	—	—	2	2	1	3	3	5	5
85.5–90	—	—	1	1	2	—	3	1	2
Over 90	1	—	2	1	3	4	1	2	5
Base	*64*	*78*	*123*	*152*	*180*	*176*	*112*	*79*	*89*
Average weight	54.6	55.0	58.6	60.0	62.3	63.8	64.0	64.6	69.2

Table 4.2 – *continued*

(d) Age 40–49

Weight in kilos	Height of men (cms)								
	Up to 165.0	165.1 –167.5	167.6 –170.0	170.1 –172.5	172.6 –175.0	175.1 –177.5	177.6 –180.0	180.1 –182.5	Over 182.5
	%	%	%	%	%	%	%	%	%
Up to 45	1	—	—	—	—	—	—	—	—
45.5–50	—	—	—	—	1	—	—	—	—
50.5–55	5	1	1	2	1	—	—	—	—
55.5–60	15	3	6	4	1	4	2	—	—
60.5–65	28	21	13	9	8	3	8	2	1
65.5–70	22	21	23	18	14	16	7	8	3
70.5–75	12	26	17	21	26	15	17	13	17
75.5–80	7	9	14	13	17	18	22	19	10
80.5–85	7	8	18	18	16	17	19	21	19
85.5–90	3	8	5	8	8	11	11	17	20
90.5–95	—	—	4	5	5	11	5	10	11
95.5–100	—	3	—	1	3	1	3	4	7
Over 100	—	—	—	2	—	5	6	7	11
Base	*79*	*69*	*100*	*120*	*128*	*99*	*101*	*66*	*68*
Average weight	66.8	72.1	73.1	75.9	76.1	79.5	80.0	83.7	86.9

Weight in kilos	Height of women (cms)								
	Up to 152.5	152.6 –155.0	155.1 –157.5	157.6 –160.0	160.1 –162.5	162.6 –165.0	165.1 –167.5	167.6 –170.0	Over 170.0
	%	%	%	%	%	%	%	%	%
Up to 45	9	2	2	1	1	—	1	—	—
45.5–50	17	12	7	6	4	2	2	2	—
50.5–55	24	27	21	19	16	5	7	6	—
55.5–60	20	26	25	21	20	22	13	16	9
60.5–65	15	12	18	19	24	23	22	26	12
65.5–70	7	6	15	13	18	23	23	21	19
70.5–75	2	8	5	9	8	7	12	11	26
75.5–80	3	3	3	7	2	8	9	6	17
80.5–85	1	2	2	3	3	2	3	3	3
85.5–90	1	—	2	1	2	4	3	4	9
Over 90	1	2	1	1	2	3	6	6	5
Base	*65*	*82*	*118*	*153*	*125*	*131*	*102*	*68*	*55*
Average weight	57.4	59.6	60.4	62.4	63.2	66.5	68.7	67.7	73.6

(e) Age 50–64

Weight in kilos	Height of men (cms)								
	Up to 165.0	165.1 –167.5	167.6 –170.0	170.1 –172.5	172.6 –175.0	175.1 –177.5	177.6 –180.0	180.1 –182.5	Over 182.5
	%	%	%	%	%	%	%	%	%
Up to 45	3	—	—	1	—	—	—	—	—
45.5–50	3	1	1	—	1	—	—	—	—
50.5–55	8	4	2	2	1	—	—	—	—
55.5–60	15	11	7	6	4	5	1	—	—
60.5–65	21	13	9	9	6	2	4	8	—
65.5–70	21	26	22	16	15	14	14	2	4
70.5–75	16	19	20	25	20	14	16	9	10
75.5–80	8	11	18	22	20	22	18	20	13
80.5–85	4	7	10	10	15	18	22	24	25
85.5–90	1	4	9	5	10	16	15	13	9
90.5–95	—	3	1	3	4	4	3	15	15
95.5–100	—	—	2	1	3	4	4	4	5
Over 100	—	1	1	1	3	1	3	6	17
Base	*186*	*132*	*179*	*167*	*169*	*129*	*99*	*45*	*57*
Average weight	65.1	70.1	73.1	73.3	76.8	78.5	79.7	83.3	87.6

Table 4.2 – *continued*

(e) Age 54–64

Weight in kilos	Height of women (cms)								
	Up to 152.5	152.6 –155.0	155.1 –157.5	157.6 –160.0	160.1 –162.5	162.6 –165.0	165.1 –167.5	167.6 –170.0	Over 170.0
	%	%	%	%	%	%	%	%	%
Up to 45	9	4	3	2	2	—	2	—	—
45.5–50	17	7	7	4	4	4	2	1	—
50.5–55	17	22	14	11	13	8	7	4	—
55.5–60	21	17	25	21	18	14	11	12	13
60.5–65	12	22	18	18	21	23	18	21	20
65.5–70	9	15	11	14	16	20	19	13	15
70.5–75	8	5	9	11	12	13	19	24	9
75.5–80	5	4	9	5	5	6	6	10	17
80.5–85	2	2	0	4	4	6	5	4	17
85.5–90	—	2	2	6	3	4	5	4	5
Over 90	—	1	2	3	3	3	6	6	4
Base	*166*	*151*	*227*	*238*	*199*	*167*	*92*	*76*	*58*
Average weight	58.0	60.9	63.0	65.6	64.8	67.2	68.8	70.8	72.5

4.7) still show height as an important determinant of weight at any age, particularly among the men.

In each male age group, there was nobody over 95 kilos in the shortest height range (up to 165cms), whereas in the tallest group (over 182.5cms) 7% of those in their twenties were over 95 kilos, rising to 22% among men turned 50. At the other end of the weight distribution, the tallest group included very few men under 60 kilos while in the shortest group, more than a fifth were under 60 kilos in every age band.

This strong association of weight with height is summarised by Table 4.3 which shows the calculated correlation coefficients between the two variables. The correlations are around 0.47 for men whereas for women they are close to 0.35. In other words height is not quite so important a predictor of female weight as it is of male weight. The female height by weight tables reflect this fact. While the modal weight range still moves up as one looks at the taller height ranges, the weight distribution in any single height range shows a greater spread among the women (especially the oldest women) than among their male counterparts.

When the average weights are plotted within the height ranges shown in Table 4.1 the relationship between height and weight appeared to be quite close to linear (see Figure 4.1).

Linear regression lines for the effect of height and weight were fitted separately for each age group of men and women* and these have been plotted in Figure 4.2. The slope of regression lines tells a similar story to the correlation coefficients in Table 4.8. If weight were determined by height in the same ratio for both men and women the slope of the regression lines would be the same for both sexes. But in Figure 4.2 it can be seen that the weight of women, particularly the older women, increased less with height, than did the weight of men.

Table 4.3 Correlation of height and weight by age

Age group	Product moment correlation coefficient	
	Men	Women
16–19	0.47	0.43
20–29	0.48	0.34
30–39	0.45	0.35
40–49	0.47	0.36
50–55	0.51	0.34
60–64	0.47	0.27

Comparison with the American HANES study was made possible by converting plotted points on their pounds and inches regression lines into kilos and centimetres, and drawing their lines on the same axis as the GB regression lines which were recalculated to coincide with the age breakdowns used in HANES. The results shown in Appendix D proved to be much the same for both surveys, which means that the relationship between height and weight was similar in both countries.

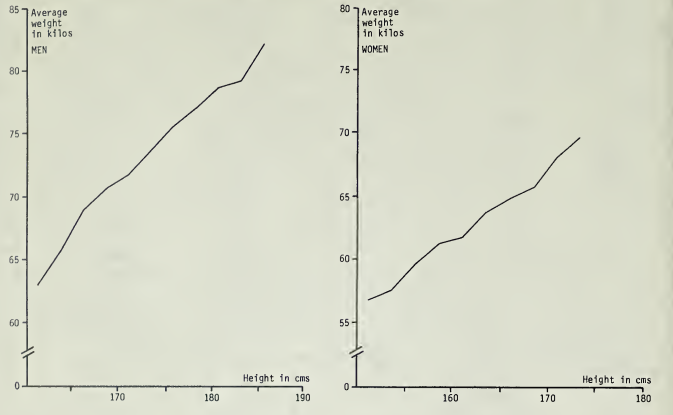
Allowing for the effect of height on average weight

The results of this analysis can be used to allow for the effect of lower average height on the average weights of the older age groups and thus overcome the severe limitations of the weight by age figures in Chapter 3. One established means of doing so is to standardise height by means of regression coefficients.[8]

The linear regression coefficients provide an estimate of the ratio of kilogrammes to centimetres. If the age groups are each adjusted to the same average height then the effect of height on average weight can be allowed for by the estimated ratio of kilogrammes to centimetres. This method has been used to adjust the mean weights by age to a constant height of 176.0cms for men and 162.0cms for women and the results are plotted as graphs on Figure 4.3.

* Linear regression lines of the standard form y = mx+c were fitted to the data by the least squares method. The regression coefficients to which the text refers are the 'm' in the equation.

Figure 4.1 Graph of average weight for height



The graph for women shows a general tendency to higher weight with age which tails off in middle age. The graph for men shows a similar tendency but the rate of weight increase slows down at an earlier age. The peak in average male weight in the late forties age group which was evident from the raw data becomes far less evident, with maximum weight occurring among men in their early sixties.

Some anthropometric studies have pursued this analytical approach by adjusting weight *distributions* in order to estimate percentiles with height held constant, but this report will concentrate on the analysis of relative weight by the use of weight for height indices.

Index weight

A number of different indices have been constructed to measure relative weight but the two in general use are the Body Mass Index (often referred to as the Quetelet Index), and the Ponderal Index. These are commonly labelled as indices of obesity although they do not measure body fat directly.

Any weight measure must include bone, water and non-fat tissue as well as fat, whereas obesity relates to an excess of fat in that combination. Some insurance companies' statistics classify people by skeletal size in terms of small, medium or large frame size in an attempt to allow for the bone component. However these three categories have not been specified or defined in terms of anthropometric measurements and must be based on the judgement of the measurer or statistician.* Since there is no way to ensure consistency of such judgement between (or even within) measurers, the classification is not a reliable one for survey data.

The level and distribution of fat on the body are usually estimated (outside of laboratory conditions) by the use of skinfold measurements.

These involve taking up a fold of the subject's flesh between the measurer's thumb and finger, and measuring the thickness of that fold. But in order to measure skinfolds with any degree of reliability the correct body position of each measure has to be located very accurately. The most commonly taken measure of this type, the triceps skinfold, is located half way down the upper arm, and involves baring the subject's arm to the shoulder. The two other most commonly recommended skinfolds (sub-scapular and supra-iliac) both involve baring the subject down to the hip bone. Apart from the difficulty in ensuring consistency of digital pressure on the skinfold, which is essential for reliable results† there was the much greater problem of subject acceptance.

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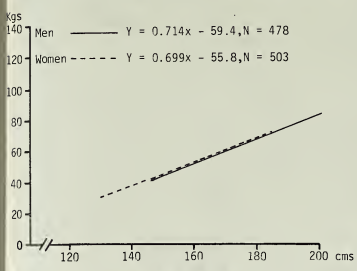
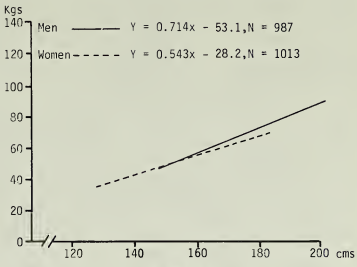
* It is extremely difficult to ensure any consistency between measurers in judgement of frame size or body type (see A Harris[12]).

† Accurate skinfold measurement takes considerable experience to achieve consistency. Inexperienced measurers tend to produce biased results in the direction of undermeasurement, and even among experienced measurers there can be significant inter-observer error (see Garrow[13]).

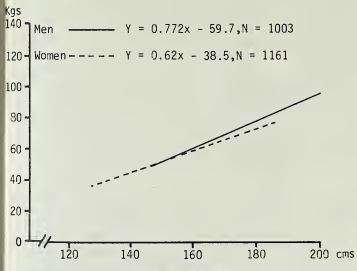
Figure 4.2 Regression of weight on height by age: men and women



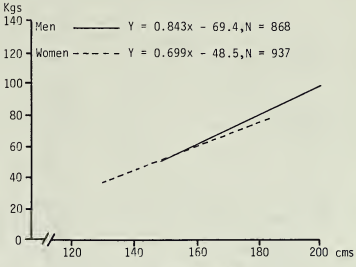
Age 16-19



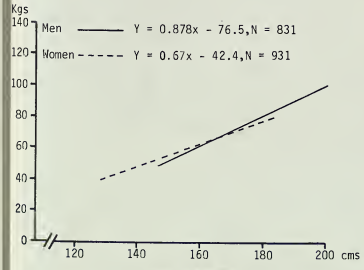
Age 20-29



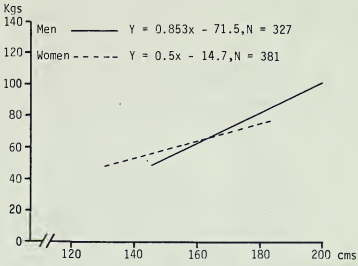
Age 30-39



Age 40-49

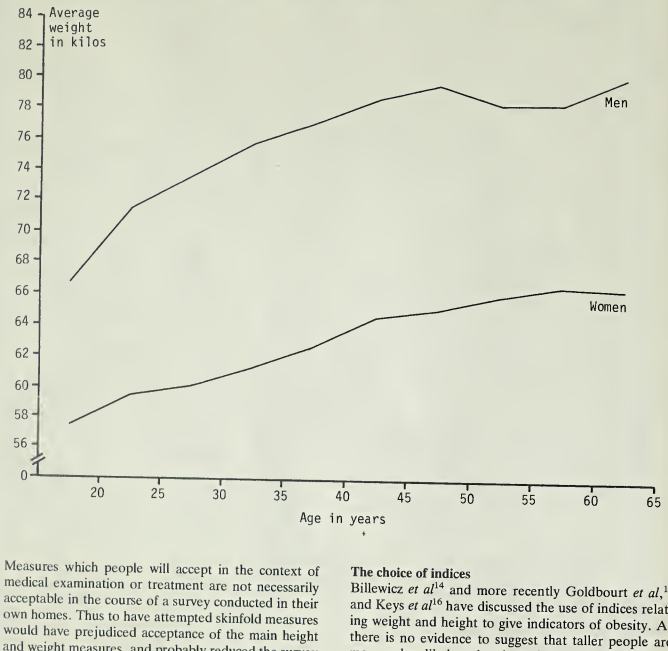


Age 50-59



Age 60-64

Figure 4.3 Average weight, adjusted for height, by age



Measures which people will accept in the context of medical examination or treatment are not necessarily acceptable in the course of a survey conducted in their own homes. Thus to have attempted skinfold measures would have prejudiced acceptance of the main height and weight measures, and probably reduced the survey response rate to an unacceptable degree, so skinfolds were not measured in this study.

Notwithstanding the lack of these more direct measures of obesity however, the present survey has followed other researchers[1] in identifying the overweight and obese by means of a weight for height index.

The choice of indices

Billewicz *et al*[14] and more recently Goldbourt *et al*,[15] and Keys *et al*[16] have discussed the use of indices relating weight and height to give indicators of obesity. As there is no evidence to suggest that taller people are more or less likely to be obese, it follows that an index should not correlate with height ie similar proportions of tall and short people should fall into the obese category. Kemsley's work showed that for his data, the Ponderal Index, $H/W^{\frac{1}{3}}$ tended to be correlated with height as did a simple $\frac{W}{H}$ index, but the Body Mass (Quetelet) Index $\frac{W}{H^2}$, showed little or no relationship with height. Similar conclusions were reached by Gold-

Table 4.4 Correlation of relative weight indices with height

Correlation of height with:	Men by age					Women by age				
	16–19	20–29	30–39	40–49	50 and over	16–19	20–29	30–39	40–49	50 and over
Body Mass Index $\frac{W}{H^2}$	−0.02	−0.07	−0.05	−0.03	0	0	−0.12	−0.09	−0.06	−0.11
Simple Index $\frac{W}{H}$	0.25	0.23	0.22	0.24	0.28	0.23	0.12	0.14	0.16	0.11
Ponderal Index $H/W^{\frac{1}{3}}$	0.31	0.37	0.32	0.30	0.27	0.24	0.34	0.32	0.29	0.32
Number of observations (unweighted)	*478*	*986*	*1,002*	*870*	*1,158*	*503*	*1,013*	*1,162*	*935*	*1,311*

bourt's later study. Using his own data on Israeli public sector workers and the results from other studies, he concluded from an analysis of regression of weight on height that $\frac{W}{H^2}$ was the 'obvious choice' to result in an index uncorrelated with height.

The results of the present study were analysed to see whether they supported the previous work and the resulting correlations are shown below in Table 4.4. Since the average level of these indices tends to increase with age the correlations are shown for different age groups, for males and females separately, but the general pattern of the results is the same in all subgroups. The Ponderal Index shows the greatest positive correlation with height, whilst the simple $\frac{W}{H}$ index correlation with height is somewhat smaller in nearly all sub-groups. The BMI results actually show a negative correlation with height but nearly all of the coefficients are so small that they may be regarded as approximating to zero.

It has been suggested that $\frac{W}{H^2}$ is merely a special case of the function $\frac{W}{H^p}$ where 'p' varies according to the population under study (Billewicz,[14] p 183). Cole[17] reported that this power 'p' can best be estimated for a population by use of the regression coefficient from a log regression of weight on height in the form:

$$\text{Log}_e W = m\text{Log}_e H + c.$$

This regression was undertaken for the age–sex groups featured in the simple linear regressions shown earlier and in all cases, the coefficients approximated to 2.

For these reasons then the BMI ($\frac{W}{H^2}$) has been used as the main index for analysis in the present study, although Appendix E does contain analysis by the Ponderal Index for those wishing to compare it with such calculations derived from other surveys.

Body Mass Index by age and social class

Table 4.5 shows the distribution of BMI within male and female age groups. The class intervals for BMI have been chosen to identify levels of relative weight which might be of some medical interest. Of course any absolute thresholds will seem arbitrary but it has been suggested that those with BMI of 20 or less should generally be regarded as underweight. Those over 25 BMI could be regarded as overweight and people with BMI above 30 could be regarded as obese.

Looking first at the overall results for men and women it can be seen that more men had a BMI above 25 (39%) than women (32%). However, above the obesity threshold of BMI = 30 there were more women than men. The distribution stretches up to BMI above 40 but the numbers are too small to round up to a whole percentage point; only 0.1% of men and 0.4% of women were found to be above this threshold.

The distribution within age groups show a trend similar to that found in the weight standardised for height figures by age (see Figure 4.3). Among the women the proportion overweight and/or obese rises steadily with age while for men there is a peak in the late 40s and another in the early 60s age group.

Table 4.6 shows that there is some association between BMI and social class which is largely independent of age. If the 16–19 year olds are omitted, which would include some who are still growing, the average BMI for men is highest in Social Class III (manual), which

Table 4.5 Percentage distribution of quetelet index by age and sex

Body Mass Index	All ages 16–64	16–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64
	%	%	%	%	%	%	%	%	%	%	%
	Men										
20 or under	10	33	14	9	7	8	3	3	5	7	6
Over 20–25	51	56	64	61	53	51	47	43	44	43	39
Over 25–30	33	9	19	26	34	35	42	44	45	42	44
Over 30–35	5	2	3	3	5	5	7	9	5	7	10
Over 35–40	1	—	—	0	1	1	1	1	0	1	0
Over 40	0	—	—	—	—	0	0	—	—	—	0
Base	*4,499*	*480*	*516*	*537*	*520*	*453*	*433*	*394*	*417*	*427*	*316*
Average value	24.3	21.4	23.0	23.8	24.5	24.7	25.3	25.7	25.2	25.2	25.4
Median value	24.5	21.5	22.5	23.5	24.5	24.5	25.5	25.5	25.5	25.5	25.5
Standard error of average	0.05	0.15	0.15	0.13	0.13	0.19	0.15	0.19	0.17	0.17	0.25
	Women										
20 or under	14	33	23	18	16	11	7	7	9	6	8
Over 20–25	54	53	56	62	57	61	57	54	48	46	41
Over 25–30	24	11	16	14	22	20	28	28	30	34	36
Over 30–35	6	2	4	4	4	6	6	7	10	12	10
Over 35–40	2	0	1	1	0	2	2	2	3	1	4
Over 40	0	0	0	0	0	0	1	1	1	1	1
Base	*4,935*	*497*	*547*	*556*	*559*	*492*	*481*	*413*	*491*	*484*	*398*
Average value	23.9	21.8	22.7	22.9	23.4	23.9	24.6	24.9	25.2	25.4	25.7
Median value	23.5	21.5	22.5	21.5	22.5	23.5	23.5	24.5	24.5	24.5	25.5
Standard error of average	0.08	0.14	0.18	0.17	0.15	0.16	0.19	0.19	0.24	0.18	0.25

Table 4.6 Average BMI by social class within age

Social class		Men						Women					
		16–19	20–29	30–39	40–49	50–59	60–64	16–19	20–29	30–39	40–49	50–59	60–64
I and II	BMI	21.0	23.0	24.3	25.1	25.3	25.8	21.5	22.4	22.8	23.6	25.0	25.0
	Base	*108*	*237*	*287*	*237*	*193*	*81*	*108*	*249*	*280*	*243*	*192*	*76*
III (non-manual)	BMI	21.2	23.1	24.1	25.0	24.9	25.4	21.5	22.4	23.2	24.3	24.5	25.3
	Base	*60*	*115*	*101*	*80*	*84*	*36*	*59*	*137*	*110*	*103*	*154*	*54*
III (manual)	BMI	21.9	23.9	25.0	25.8	25.5	25.3	22.1	23.1	23.9	25.3	25.6	26.0
	Base	*167*	*437*	*385*	*337*	*345*	*110*	*193*	*398*	*391*	*311*	*330*	*121*
IV and V	BMI	21.4	23.1	24.7	25.6	24.7	25.4	22.0	23.0	24.5	25.3	25.6	26.5
	Base	*90*	*195*	*169*	*144*	*182*	*62*	*81*	*219*	*166*	*147*	*192*	*85*

Table 4.7 Percentage distribution of Body Mass Index by region and sex

Body Mass Index	Region										
	Scotland	North	Yorks and Humberside	North West	East Midlands	West Midlands	East Anglia	Greater London	Rest of South East	South West	Wales
	%	%	%	%	%	%	%	%	%	%	%
	Men										
20 or less	9	10	10	11	11	11	4	11	11	9	6
Over 20–25	54	48	50	49	48	52	56	51	53	54	51
Over 25–30	33	36	33	34	33	32	32	33	32	32	37
Over 30–35	5	5	7	6	7	5	6	5	4	5	6
Over 35–40	0	1	1	1	1	1	1	1	0	0	—
Over 40	—	—	0	—	—	—	1	0	0	—	1
Base	*397*	*262*	*368*	*546*	*332*	*446*	*134*	*551*	*861*	*384*	*217*
Average value	24.2	24.5	24.5	24.4	24.6	24.3	24.7	24.3	24.0	24.3	24.7
Standard error of average	0.21	0.13	0.17	0.15	0.16	0.11	0.21	0.23	0.10	0.21	0.23
	Women										
20 or less	15	14	15	14	13	12	14	17	15	12	11
Over 20–25	56	53	52	56	53	53	54	51	57	50	57
Over 25–30	22	25	25	21	25	27	23	23	20	28	25
Over 30–35	6	7	6	6	7	7	7	5	7	8	4
Over 35–40	1	1	1	2	2	1	2	3	1	2	2
Over 40	0	—	1	0	1	—	—	1	1	0	1
Base	*453*	*283*	*396*	*617*	*353*	*477*	*139*	*616*	*937*	*418*	*247*
Average value	23.6	24.0	24.0	23.9	24.3	24.1	24.3	23.9	23.7	24.4	24.1
Standard error of average	0.15	0.28	0.29	0.22	0.32	0.19	0.40	0.31	0.15	0.29	0.27

Table 4.8 Change in weight among men and women since age 21

	Body Mass Index							
	Men				Women			
	20 or less	Over 20 –25	Over 25 –30	Over 30	20 or less	Over 20 –25	Over 25 –30	Over 30
	%	%	%	%	%	%	%	%
Weight change since age 21								
Over 20 kilos less now	3	1	1	—	2	1	1	1
Over 10–20 kilos less now	14	3	1	2	7	3	1	0
½–10 kilos less now	63	24	6	3	50	18	4	1
No change	2	3	1	0	3	3	1	1
½–10 kilos more now	17	57	40	14	37	62	37	7
Over 10–20 kilos more now	1	12	43	31	0	13	47	24
Over 20 kilos more now	—	1	8	49	—	1	10	65
Base (all over age 30)	*138*	*1,168*	*991*	*181*	*275*	*1,522*	*786*	*279*
Perceived weight change of those who did not give weight at age 21								
Weight less now	33	17	7	15	38	22	19	6
Weight about the same	44	29	10	6	37	23	6	2
Weight more now	23	54	83	79	25	56	75	93
Base (all over age 30)	*26**	*179*	*181*	*34**	*42*	*220*	*135*	*59*

* *Base is small and percentages should be treated with caution*

Table 4.9 Average weight increase since age 21 by current age

	Men				Women			
	30–39	40–49	50–59	60–64	30–39	40–49	50–59	60–64
Average weight increase since age 21 (kilos)	5.2	7.6	7.7	7.8	4.7	7.7	8.5	9.5
*Base**	*766*	*713*	*728*	*268*	*889*	*768*	*808*	*354*

* *Based on all over 30 who could recall weight at age 21*

Table 4.10 Recall of parents' weight by subjects who knew their parents*

Recall of parent's weight	Body Mass Index									
	Men					Women				
	All men	20 or less	Over 20 –25	Over 25 –30	Over 30	All women	20 or less	Over 20 –25	Over 25 –30	Over 30
	%	%	%	%	%	%	%	%	%	%
Father was:										
On the heavy side	17	10	14	21	24	15	9	14	19	23
Average	55	49	57	54	43	55	55	56	53	47
Slim	9	14	9	7	11	13	14	13	11	14
Underweight	12	16	12	11	11	11	15	11	10	8
Can't recall/DK	8	11	8	7	11	7	7	6	7	8
Mother was:										
On the heavy side	30	19	27	34	45	31	20	29	36	44
Average	46	46	49	43	37	44	47	45	44	35
Slim	10	13	11	9	8	12	14	13	10	10
Underweight	9	13	9	8	7	10	16	11	8	6
Don't know	5	9	4	5	3	3	2	3	3	6
*Base**	*3,694*	*274*	*1,808*	*1,365*	*232*	*4,281*	*519*	*2,318*	*1,059*	*369*

* *This question was only asked of those who knew their biological parents and could be expected to make such judgements.*

would be mainly skilled manual workers, within all but the oldest age group. The results for women show the greatest tendency to be overweight among those from households headed by any manual worker ie Social Classes III (manual) or IV or V. Social class differences in BMI were generally greater among women than men.

BMI and region

Regional analysis, in Table 4.7, shows that both the proportion overweight (BMI above 25) and the average index value were higher than general in the East Midlands and East Anglia for men and women. Women in the South West were more likely to be obese, while Wales contained the highest proportion of overweight men. Average BMI was lowest in the South East (excluding London) and among women, in Scotland.

Weight change since the age of 21

Respondents over the age of 30 were asked about their change in weight since the age of 21.* More than 4 in 5 remembered sufficiently well to put a figure to it, and a further tenth replied in terms of 'more' or 'less' or 'about the same'. The method of presenting the results, in Table 4.8, is to give the percentages losing or gaining so many kilos in each BMI category.

Those likely to be underweight (BMI = 20 or less), and those who were overweight, had undergone the greatest weight change since the age of 21, which suggests that their current relative weight is strongly associated with changes in their adult lifetime.

Where the exact weight was recalled, it seems that women were inclined to gain slightly more than the men, but this could not show in the simpler categorisation used for those who could not remember their weight at age 21.

Separate analysis within age groups (Table 4.9) shows that the average weight gain among women since age 21 rose with age (from 4.7 kilos among women in their thirties to 9.5 kilos among women of 60 or older). Among the men weight gain reached a plateau in the forties age group at 7.6 kilos with little evidence of increase beyond that age.

Relative weight of parents recalled

The survey also asked subjects to recall the relative weight of their parents. This was not simply an attempt to measure hereditary effects, since the common eating patterns and lifestyle of parents and children could be as important a cause of similarity between the two. But to establish the *degree* of association between overweight parents and overweight offspring is useful even if the cause, or causes, cannot be discovered at this stage.

Since weight varies far more than height over time it was not feasible to ask subjects about their parent's weight in precise terms. But other research at the London School of Hygiene and Tropical Medicine† had shown that people could readily identify whether their parents tended towards obesity as long as suitable

* These data are subject to the limitations explained in Chapter 3.

† The researchers are indebted to Dr P Fox for his advice on this matter.

euphemisms were used. The questionnaire asked whether their mother and father (separately) were, at about the subject's current age, on the heavy side or about average or inclined to be a little underweight. Some of them felt that they wanted to use the term 'slim' even though this was not suggested in the question, and it could well be that this was euphemism for underweight. (In the table which follows 'slim' has been placed between average and underweight since the reader may wish to see it as belonging to either of those categories.)

Table 4.10 shows the results of this recall of parental weight and it can be seen that the recall of women about their parents is very similar to that of men. Overall, those at higher BMI levels were more likely to say that their parents were on the heavy side.

Obese people (BMI over 30) were more than twice as likely as underweight people to have had parents "on the heavy side". To a lesser extent, the converse was true, with underweight people being more likely (than obese people) to have had underweight parents.

Both men and women were more likely to recall mothers on the heavy side than fathers. These results would have been biased towards parents of large families since one of their children would have a greater probability of appearing within any random sample. However that would be of significance only if fathers and mothers of large families were systematically more inclined (or less inclined) to be obese than were parents of smaller families.*

* See Chapter 5 for some evidence that women who have had a larger number of pregnancies have a higher average BMI.

5 Characteristics associated with relative weight

This chapter will examine behavioural and other features of the survey subjects which might be associated with relative weight as measured by Body Mass Index. Some of these features may indicate weight consciousness while others may explain differences in relative weight.

Dieting

One of the most useful indicators of sensitivity to obesity must surely be dieting. All subjects were asked to indicate whether they had been on a slimming diet in the past 12 months, and the results show 30% of the women claimed to have done so compared with only 10% of the men.

This measure depends on memory of up to 12 months and may represent an underestimate but it does include those who have been on slimming diets relatively recently though they are not currently on a diet. More importantly perhaps, it allows those who feel that they should be dieting to report some dieting in the past. Probably a more reliable measure comes from the proportion of subjects who are currently on a slimming diet, as long as this is not unduly affected by seasonal factors ruling at the 'time of fieldwork'.* By this measure only 5% of men and 13% of women were dieters. For the remainder of the report this latter group will be characterised as 'current dieters', while those who report dieting in the last 12 months, but not at the time of interview, will be characterised as 'recent dieters'.

Recent dieters were significantly more likely to be overweight than non-dieters and current dieters were more overweight than recent dieters (Table 5.1).

The age distribution of these two groups shows that dieting was less common among the under 20s particularly among the men, and relatively less popular among women over 55. The age group most likely to be dieting were those in their 30s.

Middle class men were a little more likely to have been on a diet than their working class counterparts, but dieting was equally common among women of every social class.

Although there was a question on the self completion form given to all subjects, just over one in eight current dieters failed to record how long they had been on their present diet. But if this lack of data is ignored, the distribution of time on present diet seems to have two peaks: one at less than a week and another at between one and six months (Table 5.2). These peaks might be said to represent the 'good intentions' and the 'good performance' dieters respectively, although the first group will obviously contain some people on their way to the second group.

There is no identifiable association between time on present diet and relative weight (BMI) but that might well be because those who are most overweight are most likely to be on long term diets.

Table 5.1 Slimming diets by age, class and average BMI

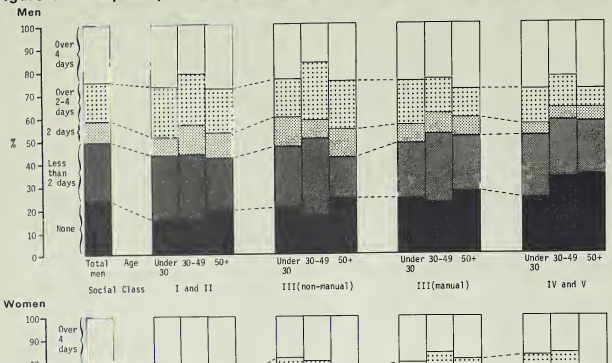
	Men			Women		
	Non-dieters	Recent dieters	Current dieters	Non-dieters	Recent dieters	Current dieters
Age last birthday	%	%	%	%	%	%
16–19	11	4	2	11	9	8
20–24	11	12	7	10	16	11
25–29	11	12	12	9	12	13
30–34	11	17	16	10	14	13
35–39	10	18	13	10	12	13
40–44	10	11	10	9	12	11
45–49	9	11	9	9	7	9
50–54	9	6	13	11	7	10
55–59	10	5	10	11	6	6
60–64	7	5	8	10	3	5
Social Class						
I and II	26	35	33	25	26	26
III (non-manual)	11	12	15	14	13	13
III (manual)	43	38	37	39	43	41
IV and V	20	15	15	21	18	20
Base	*4,305*	*196*	*260*	*3,660*	*921*	*634*
Average BMI	24.1	26.6	27.0	23.3	25.0	26.1

Table 5.2 Time on diet of male and female current dieters

Time on current diet	All giving time on current diet	
	Male current dieters	Female current dieters
	%	%
Up to 1 week	28	28
Over 1–2 weeks	11	14
Over 2 weeks–1 mth	6	14
Over 1 month–6 mths	27	24
Over 6 months–1 year	9	10
Over a year	18	10
Base	*260*	*634*

* The author of this report knows of no nationally representative data on seasonal variation in dieting as such, but it is understood that sales of 'weight losing' (as opposed to 'weight watching') slimming foods tend to peak in the spring and to a lesser extent just after Christmas. Thus it seems unlikely that the survey estimate of current dieting, based on fieldwork in late summer, is likely to be unduly high.

Figure 5.1 Frequency of recreational exercise each week by age and social class



Recreational exercise

The survey did not attempt to measure all forms of exercise taken by subjects, but concentrated on exercise taken by choice in a recreational context. Yet even recreational exercise is not simply a health or weight consciousness indicator; the exercise may not be taken for its own sake, but rather as a by-product of an activity valued for other reasons.

To define recreational exercise in lay terms proved impractical without recourse to examples. Thus the question was asked in terms of activities from a list printed on a card shown to the subject.* Subjects were asked if they had taken part in any of the listed activities in the past 14 days, and for those who had, on how many days had they taken part in any such activities. This method does ensure that the answers given relate to the concept the researcher has in mind. But it also tends to reduce the number of positive answers. The examples inevitably become the definition for some subjects, who will then only give positive answers if the particular examples relate to them. On the other hand, the number of positive answers would have been increased by the time of year when the question was asked. The survey fieldwork took place in the summer and some of the listed activities were outdoor ones which tend to be more popular in the summer. (The extra risk of untypically enhanced activity during a summer holiday was avoided by checking that the reference period did not include any time 'on holiday'.)

Figure 5.1 shows that 23% of men and 31% of women took no recreational exercise over the fortnight preceding their interview.

As might have been expected, the absence of reported recreational exercise is age related. For both sexes, subjects in the 50–64 age group were less likely to take exercise than were their younger counterparts; and among women the proportion taking no exercise generally increases with age. However, the survey results also show that the taking of recreational exercise is class related. Among both male and female subjects, the proportion taking exercise generally declines with social class after age has been taken into account.

* See show card L in Appendix C.

The average BMI was lower among those who reported some recreational exercise, both for men (24.2) and for women (23.6), than among the less active members of the sample whose average values were 24.8 (men) and 24.6 (women).

The frequency of recreational exercise shows a rather different distribution from the incidence results. Taking exercise at all, is principally a matter of attitude, but the *frequency* of recreational exercise may well be limited by available leisure time. This, in turn, probably explains why the 1977 General Household Survey[18] found, for a number of recreational exercise activities, that the frequency rate increased with age, and why the same pattern is evident in this survey. Among those of the 50 and over age group who did take exercise, the frequency was higher than among the younger exercise takers.

While class differences in frequency are not statistically significant here, there is some indication that older male exercise takers in the lowest social classes have a slightly higher frequency rate than do other groups.

If exercise takers are considered as a whole, there was only a limited association between frequency of exercise taking and BMI (see Table 5.3), but this could be accounted for by the tendency of exercise frequency and BMI to increase with age.*

Table 5.4 shows average BMI by age and frequency of taking recreational exercise. Among men under 30 average BMI tended to decline as days of exercise taking increase, though women in that age group show no significant difference in BMI with increased exercise.

Men in their 30s who take two or more days of recreational exercise a week have a lower average BMI while women in that age group show a lower average BMI than non-exercisers if they take any exercise. Both men and women in their 40s who took exercise (in comparison with those who took no exercise) had a lower average BMI as did women in their 50s and 60s. But in general, for men who have passed their fiftieth birthday there is no evidence of a lower BMI among those taking recreational exercise as defined in this survey.

Snack taking

The self completion questionnaire included a question on whether subjects ate snacks between meals '. . . . . something like biscuits, cake, crisps, or sweets'. If subjects had been consuming a significant amount of these foods in addition to their normal meals this might have been expected to increase their likelihood of being overweight.

In fact the overall result suggests that the snack takers are slightly less likely to be overweight than people who did not report this habit. Of course, as the propensity to be overweight increases with age and snack taking declines with age (see base figures in Table 5.5) the apparent inverse association of snack taking with relative weight could have been caused by age. But an analysis of snack taking by BMI within age groups showed that male snack takers in their 20s and 30s still appeared to have a lower BMI. Beyond the age of 40 however, this association broke down with no significant differences in average BMI between those who did or did not report snack taking. As with men, most women in their 30s who ate snacks between meals had a lower BMI than those of similar age without this habit. And snack taking apparently made no difference to the BMI of women over 40.

* It is possible that many older people interpreted the references to gardening and walking rather loosely.

Table 5.3 Number of days of exercise taken each week by Body Mass Index

Body Mass Index	Number of days of exercise taken each week (based on last fortnight)*					
	None	One	Two	Three	Four	Over four
	%	%	%	%	%	%
	Men					
20 or less	10	9	10	9	9	11
Over 20–25	45	51	52	56	55	54
Over 25–30	36	34	32	31	33	31
Over 30–35	8	5	5	4	2	5
Over 35	1	1	1	0	0	0
Base	*1,017*	*826*	*756*	*454*	*294*	*1,143*
Average	24.8	24.5	24.4	24.1	23.9	24.0
	Women					
20 or less	13	17	15	14	15	12
Over 20–25	47	54	59	55	59	58
Over 25–30	27	23	19	23	19	23
Over 30–35	9	4	5	6	7	6
Over 35	4	2	2	1	1	1
Base	*1,495*	*1,023*	*773*	*359*	*290*	*996*
Average	24.7	23.6	23.5	23.8	23.4	23.8

* *Half days in the two week average have been rounded up*

Table 5.4 Average BMI by age and number of days exercise taken each week

Age last birthday		Number of days of exercise taken each week (based on last fortnight)					
		None	One	Two	Three	Four	Over four
		Men					
16–29*	Days	23.2	22.9	22.8	22.9	22.6	22.3
	Base	*330*	*299*	*225*	*185*	*98*	*396*
30–39	Days	25.2	25.1	24.1	24.3	24.5	24.3
	Base	*197*	*188*	*192*	*102*	*66*	*227*
40–49	Days	26.4	25.2	25.6	24.9	24.9	25.2
	Base	*179*	*153*	*163*	*83*	*64*	*185*
50–64*	Days	25.1	25.6	25.6	25.4	24.3	25.2
	Base	*312*	*186*	*174*	*87*	*68*	*333*
		Women					
16–29*	Days	22.9	22.2	22.2	22.3	22.2	22.6
	Base	*435*	*362*	*240*	*134*	*112*	*318*
30–39	Days	24.2	23.5	23.1	23.6	23.9	23.1
	Base	*295*	*243*	*190*	*72*	*62*	*189*
40–49	Days	25.4	24.4	24.1	25.9	23.9	24.4
	Base	*274*	*194*	*145*	*54*	*56*	*170*
50–64*	Days	26.1	25.4	25.2	24.7	24.7	25.0
	Base	*487*	*216*	*191*	*99*	*61*	*321*

* *Sample numbers were too small to permit more detailed age breakdown*

Table 5.5 Snack taking anaalysed by Body Mass Index, age and sex

Body Mass Index	All ages 16–64		16–19		20–29		30–39		40–49		50–59		60–64	
	Snack takers	No snacks	Snack takers	No snacks	Snack takers	No snacks	Snack takers	No snacks	Snack takers	No snacks	Snack takers	No snacks	Snack takers	No snacks
	%	%	%	%	%	%	%	%	%	%	%	%	%	%
	Men													
Under 20	13	8	32	35	14	8	8	7	3	3	6	6	8	5
20–25	54	49	58	52	65	60	57	49	41	47	44	44	35	41
Over 25–30	29	36	7	13	19	27	31	37	47	41	45	44	46	43
Over 30	5	7	2	1	2	4	4	7	9	9	6	7	11	10
Base (weighted)	*2,055*	*2,417*	*323*	*152*	*579*	*470*	*415*	*556*	*311*	*511*	*322*	*515*	*104*	*210*
Average	23.9	24.7	21.4	21.5	23.0	23.9	24.3	24.9	25.6	25.4	25.2	25.2	25.3	25.5
	Women													
Under 20	16	13	33	34	20	20	15	13	8	7	8	7	8	8
20–25	56	52	56	47	61	58	62	54	56	55	48	46	41	42
Over 25–30	22	26	10	14	15	16	19	25	28	29	33	32	36	36
Over 30	7	10	1	5	5	6	5	8	9	9	12	16	15	15
Base (weighted)	*2,668*	*2,226*	*342*	*154*	*652*	*444*	*583*	*463*	*470*	*413*	*447*	*516*	*167*	*226*
Average	23.6	24.3	21.7	22.1	22.7	22.9	23.3	24.0	24.6	24.7	25.1	25.6	25.3	25.7

In the absence of dietary data for the survey subjects it is difficult to understand why snack taking should, if anything, be associated with lower relative weight. One can only speculate that some of the younger subjects were eating snacks as an alternative to some meals rather than a supplement.

The relationship between snack taking and BMI was similar in all social class groups and is evident irrespective of reported smoking or drinking habits.

Smoking and drinking

It has sometimes been suggested that drinking alcohol may be associated with being overweight. Of course, if true, this would clearly depend on the amount of alcohol consumed, and the accurate measurement of consumption patterns in surveys involves far more interviewing time than could be allocated to the subject within this study. However, in an attempt to identify regular drinkers, informants were asked about their usual frequency of alcohol consumption. Regular drinkers were then defined as those who reported drinking at least once a week or more.*

Smoking was also covered briefly within the survey by asking about frequency and regular smokers were defined as those who have smoked within the last 24 hours. Here the interest would be in lower weight which is said to be associated with regular smoking.

Using the definitions just described, the survey results show that 36% of the men were regular drinkers but not smokers, while 13% were regular smokers but not drinkers, and 34% reported both smoking and drinking. Among the women 25% were regular drinkers but not smokers, 20% were smokers but not drinkers and 20% smoked and drank. These figures are broadly comparable with other surveys which have measured drinking and smoking† showing only a marginally lower incidence of drinking and marginally higher incidence of smoking.

Since alcohol consumption tends to decrease with age one might expect any association with higher relative weight to emerge most clearly among the younger men. Table 5.6 shows that men in their 20s who reported drinking had an average BMI of 23.6 which was marginally higher than the figure for those who did not drink but still at the relatively low level typical of this age group.

Similarly for the men in their 30s the average BMI was marginally higher for drinkers than non-drinkers, though not significantly above that for smokers who did not drink. However among men in their 40s those who drank but were not smokers had the very same average BMI as those who did not drink or smoke. Indeed it is only from age 40 onwards that any smoking effect can be seen. Those in their 40s and 50s who were regular smokers had a significantly lower average BMI than non-smokers.

Thus it seems that among male young drinkers there may be a slight tendency towards greater relative weight than for other young men. But for older men there is some evidence that smoking is associated with a lower relative weight.

Among the women on the other hand, for all age groups over 20, the higher average BMI was consistently found among those who neither drank nor smoked regularly.

* It is known that this results in some degree of understatement, but there are some understatements of consumption in any survey methods of measuring alcohol consumption (see P Wilson[20]).

† The General Household Survey for the same period as was covered by this study[20] shows 42% of men and 37% of women as smokers. The 1978 OPCS survey of drinking in England and Wales[21] shows 77% of men as regular drinkers by reported usual frequency, and 51% of women.

Table 5.6 Average BMI of regular smokers and drinkers by age

		Age					
		16–19	20–29	30–39	40–49	50–59	60–64
Men who smoke* and drink†	BMI	21.7	23.5	24.7	25.2	24.6	24.8
	Base	*111*	*395*	*339*	*286*	*287*	*93*
smoke only	BMI	21.1	23.0	24.6	24.9	24.4	24.8
	Base	*37*	*80*	*127*	*110*	*140*	*62*
drink only	BMI	21.7	23.6	24.8	25.9	26.0	26.3
	Base	*177*	*424*	*360*	*281*	*263*	*85*
do neither	BMI	21.0	23.0	23.8	25.7	25.6	25.6
	Base	*140*	*135*	*137*	*132*	*144*	*65*
Women who smoke* and drink†	BMI	21.6	22.4	23.2	23.8	23.8	24.9
	Base	*83*	*211*	*214*	*175*	*175*	*58*
smoke only	BMI	21.9	22.8	23.6	24.4	24.6	25.3
	Base	*67*	*200*	*188*	*160*	*222*	*79*
drink only	BMI	22.0	22.7	23.0	24.8	25.1	24.8
	Base	*103*	*280*	*245*	*231*	*178*	*79*
do neither	BMI	21.8	23.0	24.3	25.2	26.5	26.8
	Base	*203*	*323*	*338*	*270*	*308*	*151*

* *Smoked in last 24 hours*
† *Drinks at least once a week*

Among both men and women, those who had given up smoking (as opposed to those who had never started smoking) had higher BMI levels than smokers.* Table 5.7 shows that the highest average BMI was found among those who had given up between one and five years ago, while those who last smoked over 5 years ago still had a noticeably higher BMI than current smokers.

Relative weight and number of pregnancies

It has sometimes been suggested that weight may also be related to number of pregnancies. The cause of such a link might be that mothers of larger families spend a greater part of their life at home caring for young children,† where the opportunities for eating are greater than outside the home; or it might be that weight put on during later pregnancies proves difficult to shed subsequently.

The straightforward way to control the effect of age and class is to analyse relative weight by the number of pregnancies within each age and class group. But Table 5.8 shows the number of pregnancies among women from 'white collar' (non-manual) and 'blue collar' (manual) families, and it can be seen that this variable is also, to some extent, class related. Moreover, number of pregnancies is self-evidently age related.

Thus, if the relative weight of mothers of larger families is to be analysed within age and class groups, the sample numbers are too small for women under 30. If, however, the analysis is restricted to women aged 30 or over there is some evidence of increased relative weight with number of pregnancies.

In Table 5.9 the average BMIs for women who have had one and two pregnancies are shown merged because there were little or no differences between these groups. The average BMIs for women with 4 or more pregnancies have had to be merged because the numbers were to small to be shown separately. Nevertheless the average BMI for women in their 40s or 50s who have had four or more pregnancies, do show a higher relative weight than that for other mothers in that age range.

Longstanding illness or disability

In an attempt to measure the association of long term invalidity with relative weight the survey asked subjects whether they were suffering from any longstanding illness or disability. The range of different complaints which can be mentioned in answer to such a question is truly enormous, and while it was theoretically possible to use the International Classification of Diseases (ICD) to categorise the answers, experience on previous surveys has shown that many subjects are only able to describe symptoms rather than diseases. So for the purposes of this survey it was decided that the coding frame should classify categories of complaint and only attempt to identify those thought likely to be associated with weight.* Consequently, although 21%

* There is no straightforward way of defining an ex-smoker if that means a person who now never smokes a cigarette. The pragmatic approach adopted in this survey was to ask people when they last smoked a cigarette and to treat those for whom the occasion was more than 7 days ago as ex-smokers. Even though such people may still have the occasional cigarette they have been regarded as being close enough to a non-smoker for the purpose of this study. However, it must be acknowledged that the group who last smoked more than 7 days ago, but within the last year, will include a small minority of people who have only ever smoked very occasionally.

† The General Household Survey data for 1979 show that the proportion of working mothers is only associated with the number of dependent children when family size exceeds 3 children:

Percentage of working mothers	Number of dependent children				
	1	2	3	4	5
Full time	18%	13%	14%	11%	10%
Part time	34%	41%	41%	29%	20%
Base of percentages	*1,412*	*1,564*	*520*	*130*	*50*

* Certain diseases were specifically included in the code list but they proved so rare they were counted separately: Crohns disease 5, Coeliac disease 2, Ulcerative colitis 7, Vagotomy nil, Pyloroplasty nil, gastric surgery (not abdominal surgery) 5.

Table 5.7 Average BMI by time when subject last smoked

		Time when subject last smoked a cigarette, pipe or cigar					
		Today	In last 7 days	Within last 12 mths	Up to 5 yrs ago	Over 5 years ago	Never
Average BMI for men		24.2	24.2	24.8	25.4	25.1	23.8
	Base	*2,071*	*243*	*303*	*234*	*530*	*1,040*
Average BMI for women		23.5	24.0	24.7	24.8	24.3	24.0
	Base	*1,843*	*138*	*255*	*190*	*478*	*1,656*

of men and women in the sample claimed to have some longstanding complaint, when those mentioning ailments outside the coding frame were excluded, there were only 9%. This is bound to represent an understatement since many people will have undiagnosed ailments, but it is still possible to see whether those with identified ailments were overweight.

In the case of osteo arthritis some respondents felt able to be more specific than others, and the category of arthritis 'not elsewhere specified' (nes) will include complaints that should have gone into the other arthritis categories. Inclusion within the coding frame does not necessarily imply that the complaint was caused or aggravated by the weight of the sufferer; in some cases the diseases will have contributed to the weight problem of the sufferer.

Table 5.10 puts these reported weight related complaints in context, and shows that none of them was mentioned by more than 4 per cent of the population,† but it also confirms that they are associated with higher BMI. Osteo arthritis was more common among women who were overweight while heart problems seem to occur more often among overweight men.

Since the incidence of weight related disease increases with age as well as weight it is possible that the increased risk of such complaints was really only attributable to age.

To investigate the issue, the list of weight related complaints was reduced by excluding those complaints likely to be associated with weight loss rather than overweight, such as cancer. The number of people aged under 40 with weight related complaints was too small for reliable analysis though almost all of the sampled individuals concerned were within the 'normal' range of BMI levels (over 20 but not above 25). However, among the subjects aged 40 or over with these weight related complaints average BMI was higher than for others of similar age without such complaints but the incidence of such diseases also increased with age (Table 5.11). So it seems that above age 40 both age and high BMI combine to increase the risk of these weight related complaints.

Although most subjects had put on weight since age 21, the amount of weight increase was age related,* and separate analysis by age of subjects reporting weight related diseases shows differing trends among men and women. As in the previous table, Table 5.12 includes as 'weight related complaints', only those which are associated with overweight, and excludes subjects under age 40.

The men under 60 showed no real difference in average weight change since age 21 between those with weight related diseases and those without. However men in their sixties with weight related diseases, did show the expected greater weight gain than other men the same age. Within the female sample however, the general propensity to put on weight in later years showed no effective difference between those with and without weight related diseases in the 60–64 age group. Yet those women under 60 with weight related diseases did show a greater average weight increase than women without such complaints.

† This is bound to be something of an underestimate, because one of the complaints – high blood pressure – will be unknown to many of its sufferers. It is quite possible that subjects who were overweight were more likely to have visited their doctor and thereby have had their weight related complaints diagnosed.

* This analysis by weight gain since age 21 is subject to the limitations explained in Chapter 3.

Table 5.8 Number of pregnancies by age and class

Number of pregnancies	Women who have been pregnant: by age and social class									
	20–29		30–39		40–49		50–59		60 or over	
	Non-manual	Manual	Non-manual	Manual	Non-manual	Manual	Non-manual	Manual	Non-manual	Manual
	%	%	%	%	%	%	%	%	%	%
One	49	40	17	16	15	13	22	25	19	23
Two	37	44	58	48	48	35	36	32	49	40
Three	11	12	20	22	22	27	24	21	17	19
Four	2	2	4	9	11	12	9	11	9	10
Five	—	1	1	3	3	7	5	5	3	4
Six or more	—	1	1	1	2	4	3	7	3	5
Base	*135*	*339*	*341*	*513*	*314*	*412*	*259*	*436*	*102*	*168*

Table 5.9 Average BMI by age, social class and number of pregnancies

Number of pregnancies		Age and social class					
		30–39		40–49		50–59†	
		Non-manual	Manual	Non-manual	Manual	Non-manual	Manual
One or two	BMI	22.8	23.7	23.5	24.9	24.6	25.4
	Base		*328*	*196*	*197*	*151*	*249*
Three	BMI	23.6	24.7	23.8	25.3	23.5	25.6
	Base	*67*	*115*	*69*	*109*	*62*	*92*
Four or more	BMI	*	24.7	24.9	26.3	27.1	26.5
	Base	*20*	*70*	*46*	*104*	*46*	*97*

* *Base number too small for reliable average*
† *Numbers for the over 60 age group were too small for separate analysis and would have introduced an age effect if added into the 50–59 age group*

Symptoms

In addition to reported long-term illness or disability the survey also asked questions about a list of physical symptoms experienced in the past fortnight which might be more common among the overweight. The symptoms specifically mentioned to respondents were:

shortness of breath
tiredness
pain in the back or limbs
pain in the hips or knees.

There is no way of knowing how severe any such symptom was in a given respondent since there is no objective scale of severity which could be used reliably in a survey* and answers were simply yes or no. Nevertheless taking the answers at face value it is clear from Table 5.13 that these symptoms grow more common with age. Among men under 20 for example, only 1 in 6 claimed any of the specified symptoms whereas half of those in their sixties had at least one symptom. The sampled women were more likely to claim these symptoms than were men but again the proportion with at least one symptom increases steadily with age.

* Since reactions to pain vary considerably between individuals objective measurement is probably impossible to achieve in any circumstances.

Table 5.11 BMI and weight related diseases by age and sex

	Men			Women		
	40–49	50–59	60 and over	40–49	50–59	60 and over
Percentage with weight increase related complaints	8%	13%	19%	7%	15%	23%
Base	*828*	*844*	*316*	*894*	*976*	*398*
Average BMI of those with weight increase related complaints	26.5	25.7	26.2	25.8	27.0	26.4
Base	*66*	*109*	*60*	*67*	*144*	*93*
Average BMI of those who did *not* report such complaints	25.4	25.1	25.2	24.6	25.0	25.5
Base	*762*	*735*	*256*	*827*	*833*	*305*

With the exception of 'tiredness' the individual symptoms also increased with age among both men and women so they tend to move in the same direction as the Body Mass Index which has been used to identify the overweight. This confusion has been removed by the age specific Table 5.14 which makes it possible to compare average BMI of those with no reported symptoms against the average BMI for those who did report symptoms, within each age group.

Table 5.10 Longstanding weight related complaints by relative weight (BMI)

Coded weight related complaints mentioned*	Body Mass Index									
	Men					Women				
	All men	20 or less	Over 20 –25	Over 25 –30	Over 30	All women	20 or less	Over 20 –25	Over 25 –30	Over 30
	Percentages									
Lung disease (excluding cancer)	4	4	4	4	2	3	3	2	3	3
Cancer	0	—	0	—	—	0	0	0	0	0
Arthritis in hands	0	—	0	0	1	1	1	1	1	1
knees	1	—	0	0	2	1	1	1	2	2
hips	0	—	0	1	1	1	0	1	1	1
spine	1	—	0	1	2	1	1	1	2	2
Arthritis n e s	1	0	1	1	3	2	1	2	3	6
Diabetes	1	0	1	1	—	1	0	0	1	1
Heart trouble	2	1	2	3	7	2	1	1	2	3
High blood pressure*†	1	—	1	1	3	1	0	1	2	4
Thyroid over active	0	0	0	0	0	0	0	1	0	—
Thyroid under active	0	—	0	0	—	1	0	0	1	3
Thyroid not specified	0	—	—	0	—	0	—	0	0	0
Stomach trouble (excluding gastric surgery)	1	1	1	1	0	0	1	0	0	0
Base	*4,499*	*449*	*2,307*	*1,482*	*261*	*4,936*	*704*	*2,667*	*1,160*	*405*

* *Some subjects mentioned more than one weight related complaint*
† *Likely to be an understatement see note in text*

Table 5.12 Weight change since age 21 comparing those with weight related discases and others by age and sex

Change since age 21	Men						Women					
	40–49		50–59		60–64		40–49		50–59		60–64	
	Weight related complaint	Others	Weight related complaint	Others	Weight related complaint	Others	Weight related complaint	Others	Weight related complaint	Others	Weight related complaint	Others
	%	%	%	%	%	%	%	%	%	%	%	%
Now over 20 kilos less	2	0	1	1	—	0	1	0	1	1	2	1
Over 10–20 less	5	1	1	2	5	4	3	2	3	3	5	1
Over 4–10 less	11	4	8	6	9	10	6	4	4	5	1	5
Up to 4 less	2	10	13	12	9	6	5	10	10	9	7	12
No change	5	2	1	1	2	1	—	2	3	1	1	1
Now up to 4 kilos more	17	17	16	13	12	17	12	19	8	15	8	11
Over 4–10 more	23	30	26	27	15	25	19	32	20	28	23	28
Over 10–20 more	22	28	23	26	37	28	33	23	26	27	34	28
Over 20 more	13	7	12	11	12	7	21	8	25	12	19	14
Base (all over 30 who gave weight at age 21)	*56*	*657*	*97*	*630*	*54*	*213*	*61*	*707*	*113*	*695*	*85*	*269*
Average change (kilos)	+7.3	+7.6	+7.8	+7.6	+9.2	+6.7	+10.8	+7.4	+12.2	+8.4	+10.4	+9.2

Table excludes those who could not remember their weight at age 21

The result of such analysis shows that pain in the hips and knees is clearly associated with weight irrespective of age among both men and women. There is some evidence that pain in the back and limbs may be associated with higher BMI among women but among the men it seems as much a result of increasing age. Similarly, among women, shortness of breath may be associated with increased BMI but within the male sample it seems to be more a function of age.

Table 5.13 Symptoms experienced in last 2 weeks analysed by age and sex

	Shortness of breath	Tiredness	Pain back/ limbs	Pain hips/ knees	None of these	*Base*
Men						
16–19 %	2	8	7	4	83	*480*
20–29 %	5	13	11	5	74	*1,054*
30–39 %	5	14	17	6	68	*976*
40–49 %	9	15	19	9	65	*830*
50–59 %	12	19	22	12	58	*849*
60–64 %	20	21	26	15	51	*319*
Women						
16–19 %	3	13	7	3	80	*499*
20–29 %	6	25	15	5	64	*1,106*
30–39 %	7	25	21	6	60	*1,054*
40–49 %	8	22	24	12	57	*900*
50–59 %	13	27	25	17	53	*978*
60–64 %	12	29	28	25	45	*401*

Table 5.14 Average Body Mass Index analysed by symptoms experienced, age and sex

		Shortness of breath	Tiredness	Pain back/ limbs	Pain hips/ knees	None of these
Men						
20–29	BMI	23.4	23.5	24.1	23.6	23.3
	Base	*54*	*136*	*117*	*55*	*768*
30–39	BMI	24.6	24.7	24.3	25.1	24.7
	Base	*45*	*137*	*161*	*61*	*657*
40–49	BMI	25.9	25.3	25.5	26.2	25.4
	Base	*70*	*125*	*159*	*74*	*531*
50–59	BMI	24.7	25.1	25.4	25.6	25.2
	Base	*101*	*156*	*182*	*96*	*485*
60–64	BMI	25.4	25.6	25.2	26.1	25.4
	Base	*62*	*67*	*80*	*47*	*161*
Women						
20–29	BMI	24.8	23.2	23.5	23.9	22.5
	Base	*67*	*272*	*159*	*52*	*700*
30–39	BMI	24.8	23.6	24.0	24.9	23.3
	Base	*71*	*260*	*222*	*64*	*627*
40–49	BMI	24.9	24.5	24.7	25.2	24.6
	Base	*66*	*190*	*212*	*108*	*511*
50–59	BMI	25.7	25.7	25.9	26.7	24.9
	Base	*120*	*259*	*241*	*163*	*509*
60–64	BMI	25.2	25.3	25.9	26.4	25.9
	Base	*48*	*115*	*109*	*97*	*177*

Table excludes those aged 16–19 because the numbers reporting pain symptoms were not large enough for reliable mean estimates

6 Husbands and wives

This final brief chapter examines the joint distribution of husbands and wives for height and relative weight.

One particular useful feature of the design for this survey was the household base of the sample which meant that husbands and wives were often weighed and measured together.* This offers an important advantage in making comparisons between individuals, because unlike the parent and offspring relationship which has inseparable elements of nature and nurture, the interrelationship between spouses will not have shared genetic influences.

Some 70% of the men who co-operated in the survey were married at the time, and in 19 out of every 20 cases their wives agreed to take part in the survey. Of course it is always possible that the small minority of households in which one of the marriage partners was not interviewed was different from the fully co-operating households in some way which was relevant to the survey variables. However, since the joint response rate of spouses was almost as good as the general response rate of spouses was almost as good as the general response rate, it does seem likely that this study provides the first representative data on the heights and weights of married couples in Britain. The results which follow are based on a sample of almost 3,000 married couples for whom both height and weight were adequately measured.

Height of married couples

Although it is common knowledge that most husbands are taller than their wives Table 6.1 shows the extent of the difference. On average men were 13.2cms (5¼″) taller than their wives but the difference was correlated with the height of the husband. Husbands up to 160cms tall (5′ 3″) were only 2.5cms (1″) taller than their wives while husbands over 187.5cms (6′ 2″) were, on average 26.6cms (10½″) taller. Yet the difference in height between the shortest and tallest group of husbands is greater than the difference in the extent to which they are taller than their wives, so there must have been some tendency for taller men to marry taller women.

Men up to 160cms (5′ 3″) tall had wives of only 155.5cms (5′ 1″) on average and it can be seen from Table 6.2 that the average height of wives tends to increase as the height of their husbands. However there is no simple linear relationship between the two variables, and the wives of the tallest men (over 187.5cms, or 6′ 2″) were not the tallest sub group of wives. In other words, though taller men tend to marry taller wives, the tallest men do not necessarily have the tallest wives.

Taking female height as the focus variable, it can be seen that taller women choose taller husbands with the tallest women clearly choosing the tallest husbands. Women of 150cms (4′ 11″) or less had husbands of 169.2cms (5′ 6½″) on average, whereas among women of 172.6cms (5′ 8″) and above, the average height of husbands was 178.5cms (5′ 10½″).

Only 4% of men were shorter than their wives and in most cases the difference was within 3cms (1¼″).

Given that men from the higher social classes tended to be taller than other men, if all men married women of average height, then the difference in height between spouses would be greater for men from the higher (and taller) social classes. However the results in Table 6.3 show that the difference in height of spouses was much the same, on average, in all the social class groups.

Indeed among men of average height and above (apart from the very tallest group) those from the higher social class were somewhat closer to the height of their spouses than men from the lower social classes.

Thus the tendency for taller men to marry taller women, and the slight tendency for taller women to marry men of a higher social class than themselves (see Chapter 2), both combine to reinforce genetically the tendency for people from the higher social classes to be taller than other people.

Relative weight

If height is reflected in the factors which can influence a choice of spouse, it is also possible that relative weight might play a part. But unlike height, relative weight can change greatly over time and is susceptible to the influence of the shared living and eating habits of spouses.

If the relative weight of husbands and wives are compared, using Body Mass Index, it appears that thinner men are more likely to be married to thinner women. But since younger people are likely to be thinner than older people (see Chapter 4) the result in Table 6.4 is partly a reflection of the fact that young people tend to be married to other young people. Table 6.4 also shows the results separately for young men (aged under 30), and it is evident that the inclination for men with low

* See introduction and Appendix A on sample design.

Table 6.1 Height difference between spouses analysed separately by height of husbands and height of wives

Difference between heights of spouses (cms)	Height of husband (ems)												
	Up to 160	160.1 –162.5	162.6 –165	165.1 –167.5	167.6 –170	170.1 –172.5	172.6 –175	175.1 –177.5	177.6 –180	180.1 –182.5	182.6 –185	185.1 –187.5	Over 187.5
Husband taller by:	%	%	%	%	%	%	%	%	%	%	%	%	%
Over 10	2	—	—	—	—	0	—	0	1	3	6	6	19
Over 5–10	—	—	—	1	2	7	11	18	29	39	48	58	72
Over 4–5	1	6	3	10	16	23	25	32	36	30	28	24	6
Over 3–4	13	17	21	24	32	34	34	29	23	18	17	9	3
Over 2–3	6	12	16	18	19	12	13	10	7	3	1	2	—
Over 1–2	10	19	19	14	15	12	8	7	3	4	—	1	—
Up to 1	16	13	17	14	8	8	6	3	1	2	—	1	—
Both were same height	14	11	12	10	5	3	2	1	1	1	—	—	—
Wife taller by:													
Up to 1	—	2	1	0	0	0	—	0	0	—	—	—	—
Over 1–2	14	8	7	4	2	1	1	0	—	0	—	—	—
Over 2–3	12	9	4	5	1	0	0	—	—	—	—	—	—
Over 3–4	9	—	1	1	0	—	—	0	—	—	—	—	—
Over 4–5	1	3	—	1	—	0	—	—	—	—	—	—	—
Over 5	3	2	—	—	—	—	—	—	—	—	—	—	—
Base	*70*	*76*	*162*	*250*	*385*	*422*	*453*	*409*	*361*	*203*	*149*	*84*	*60*
Average amount by which husband was taller than wife	2.5	5.1	6.2	7.5	10	11.9	13.1	14.9	17.2	18.6	20.9	21.7	26.6

Difference between heights of spouses	Height of wife (cms)										
	Up to 150	150.1 –152.5	152.6 –155	155.1 –157.5	157.6 –160	160.1 –162.5	162.6 –165	165.1 –167.5	167.6 –170	170.1 –172.5	Over 172.5
Husband taller by:	%	%	%	%	%	%	%	%	%	%	%
Over 10	12	4	2	2	1	1	—	—	—	—	—
Over 5–10	42	41	31	26	16	10	10	4	4	1	—
Over 4–5	28	27	36	29	26	24	18	11	8	8	1
Over 3–4	18	19	21	27	33	27	30	27	19	22	12
Over 2–3	1	5	6	8	12	14	13	15	19	12	6
Over 1–2	1	2	3	6	6	12	12	15	15	14	24
Up to 1	—	2	1	2	4	7	7	13	17	14	14
Both were same height	—	—	0	2	1	4	6	6	7	11	16
Wife taller by:											
Up to 1	—	—	—	—	—	0	0	0	0	2	3
Over 1–2	—	—	1	—	1	1	2	3	6	4	9
Over 2–3	—	—	0	—	0	1	1	3	4	8	5
Over 3–4	—	—	—	—	—	—	0	1	1	1	4
Over 4–5	—	—	—	—	—	0	—	—	—	3	5
Over 5	—	—	—	—	—	—	—	1	—	2	—
Base	*125*	*157*	*365*	*348*	*590*	*399*	*483*	*248*	*226*	*83*	*69*
Average amount by which husband was taller than wife	21.4	19.0	17.4	15.9	14.3	12.1	11.2	8.9	7.8	5.9	3.6

Table 6.2 Height of husbands analysed by height of wives

Height of wife (ems)	All husbands	Height of husband (ems)												Average height of husband (cms)
		Up to 160	160.1 –162.5	162.6 –165	165.1 –167.5	167.6 –170	170.1 –172.5	172.6 –175	175.1 –177.5	177.6 –180	180.1 –182.5	182.6 –185	185.1 –187.5	Over 187.5	
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	
Up to 150	4	18	15	7	7	7	5	2	3	2	3	2	—	—	169.2
150.1–152.5	5	13	14	9	9	7	6	5	4	3	2	1	2	2	170.6
152.6–155.0	12	18	18	19	19	14	14	12	8	10	7	8	—	5	171.4
155.1–157.5	11	13	13	15	15	14	11	10	13	10	8	7	10	3	172.4
157.6–160.0	19	16	11	20	20	18	22	20	18	18	17	19	12	17	173.3
160.1–162.5	13	7	12	14	14	13	12	13	11	16	13	9	10	13	173.5
162.6–165.0	16	10	9	10	10	15	14	17	18	17	18	22	27	22	175.1
165.1–167.5	8	6	4	5	5	3	8	10	9	10	11	10	7	13	175.3
167.6–170.0	7	—	—	2	2	5	6	8	10	9	9	12	14	16	176.6
170.1–172.5	3	—	5	—	—	2	1	2	4	3	5	7	10	5	177.3
Over 172.5	2	—	—	—	1	1	1	2	2	4	7	4	8	5	178.5
Base	*3,095*	*70*	*76*	*162*	*250*	*385*	*422*	*453*	*409*	*361*	*203*	*149*	*84*	*60*	Average for all husbands: 173.6
Average height of wife	160.4	155.5	156.5	157.7	158.9	158.9	159.5	160.7	161.4	161.6	162.6	162.7	164.6	163.9	

Table 6.3 Average amount by which husband was taller than wife analysed by height of husband and social class

Social class		All husbands	Height of husband (cms)								
			Up to 165	165.1 –167.5	167.6 –170	170.1 –172.5	172.6 –175	175.1 –177.5	177.6 –180	180.1 –182.5	Over 182.5
I and II	cms	13.4	3.0	6.5	9.7	10.2	12.0	14.7	15.9	17.1	21.8
	Base	*805*	*43*	*50*	*88*	*86*	*121*	*122*	*124*	*65*	*105*
III (non-manual)	cms	13.3	3.8	6.9	9.7	11.3	11.7	14.4	16.6	18.7	27.4
	Base	*326*	*26**	*20**	*36**	*49*	*47*	*44*	*42*	*21**	*34**
III (manual)	cms	13.4	5.5	8.3	9.9	12.1	13.5	15.0	17.8	19.9	23.0
	Base	*1,326*	*134*	*103*	*193*	*202*	*188*	*167*	*138*	*85*	*112*
IV and V	cms	12.6	5.2	6.6	10.7	13.5	14.3	15.4	19.1	18.6	21.4
	Base	*542*	*84*	*64*	*59*	*75*	*87*	*68*	*54*	*24**	*27**

** Estimate could be unreliable due to small sample size*

BMI values to have wives with a low BMI is much stronger in this age group than it is among the over 30s. Similarly the table indicates that among those over 30, fatter men have fatter wives.

Insofar as relative weight may have played a part in choice of spouse one might expect it to show in a tendency for very obese wives (BMI over 35) to be married to very obese husbands. However, the very obese women were 2% of all wives and very obese men were only ½% of all husbands; so clearly most of the very obese wives could not have chosen very obese husbands. In fact less than one in a thousand of the married couples in the survey were both very obese.

Chapter 4 revealed that although younger women tended to be thinner than younger men, male BMI increased with age only up to the forties age group and tailed off thereafter while female BMI increased with age up to the early 60s. So one would expect the difference in relative weight between husbands and wives to be at its greatest for husbands in their early 40s and to reduce with age among older men which Figure 6.1 shows to be true. Indeed it can be seen that men aged 50 or over were, on average, about the same relative weight as their wives.

Table 6.4 Husband's BMI by wife's BMI by husband's age

BMI of wife	BMI of husband			
	Up to 20	Over 20 –25	Over 25 –30	Over 30
	%	%	%	%
	Husband, all ages			
Up to 20	21	14	7	10
Over 20–25	52	58	53	49
Over 25–30	23	21	30	29
Over 30	4	7	10	12
Base	*164*	*1,439*	*1,159*	*195*
	Husband aged under 30			
Up to 20	32	21	14	*2**
Over 20–25	51	59	58	*16**
Over 25–30	16	14	22	*1**
Over 30	—	6	6	*1**
Base	*49*	*309*	*148*	*20*
	Husband aged 30–64			
Up to 20	16	11	6	10
Over 20–25	52	58	52	45
Over 25–30	27	23	31	31
Over 30	5	8	11	13
Base	*115*	*1,129*	*1,010*	*174*

** Base figures too small to give reliable percentages*

Figure 6.1 Average difference between BMI of husbands and wives by husband's age

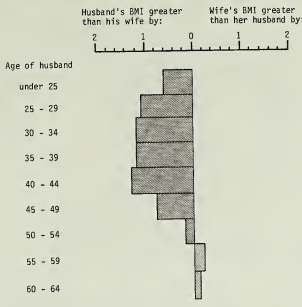


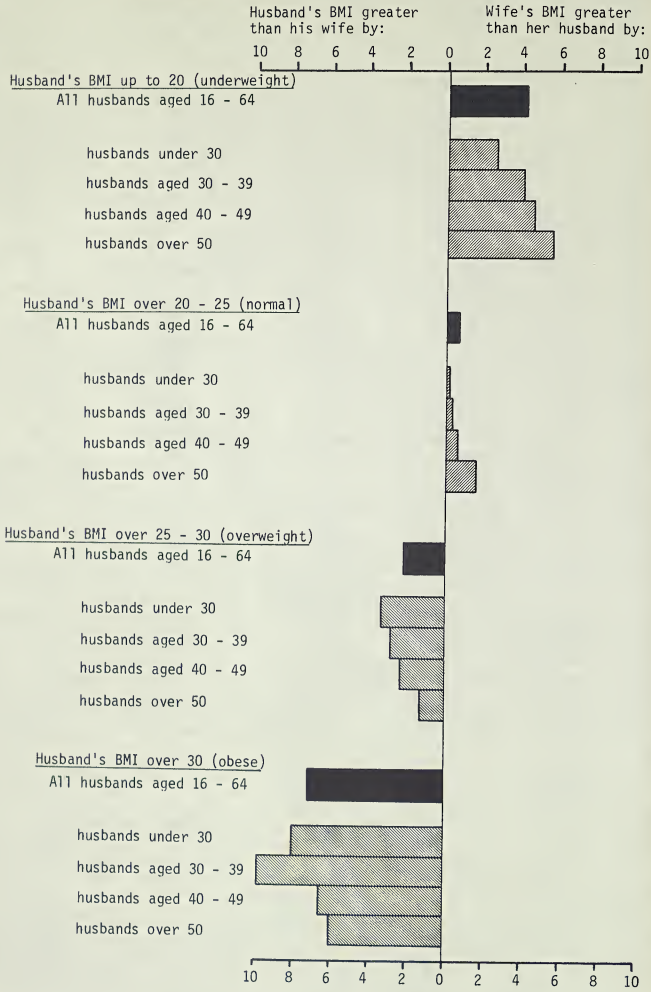
Table 6.5 shows the difference in BMI values in relative terms. The variable down the left hand side of the table measures the extent to which the Body Mass Index of husbands was greater or less than that of their wives and is analysed by BMI of the husband.

As one might expect, the fatter men were most likely to be fatter than their wives, and the table shows this quite clearly. Among the 'normal' weight husbands only half were fatter than their wives but among the overweight yet not obese husbands, some three quarters were fatter than their spouse. The obese husbands were nearly all (94%) fatter than their wives, nearly three quarters of them having a Body Mass Index at least 5 points higher.

This general trend was evident among the fatter men in all age groups (Figure 6.2) though the differences declined for men in their late 30s and early 40s who tended to reach their BMI peak at that stage while their wives were still putting on weight.

The importance of shared life style and eating patterns of married couples on relative weight would be expected to increase with the length of marriage that is, the longer they have been married the closer their BMI

Figure 6.2 Average difference between BMI of husbands and wives by husband's BMI



levels would be. But since age also increases with length of time married, it is necessary to look for any trends within age groups. Table 6.6 shows such a breakdown and as one would expect there are few young people who have been married for over 9 years and few middle aged people who have been married less than 9 years. But where the sample numbers were large enough to calculate averages there was no evidence of a systematic reduction in the difference between spouse's BMI levels with length of marriage. Indeed, apart from the youngest and oldest age groups, who had been married, on average, for the shortest and longest times, the figures actually implied an increase in the difference between spouses with length of marriage!

Table 6.5 Distribution of difference between BMI of husbands and wives

Difference between BMI of husband and wife	BMI of husband				
	Up to 20	Over 20–25	Over 25–30	Over 30	All husbands
Husband's BMI greater by:	%	%	%	%	%
More than 10 points	—	0	1	28	2
Over 5–10	—	2	23	44	13
Over 2–5	3	23	34	14	25
Up to 2 points	9	25	18	7	20
Both had same BMI	1	2	0	—	1
Wife's BMI greater by:					
Up to 2 points	21	20	10	4	15
Over 2–5	32	16	8	2	13
Over 5–10	26	10	5	1	9
More than 10 points	8	3	2	—	3
Base	*165*	*1,439*	*1,160*	*195*	*2,960*

Table 6.6 Average amount by which BMI level of husband is greater than BMI level of wife by age and length of (current) marriage

Number of years married		Age of husband						
		Under 25	25–29	30–34	35–39	40–44	45–49	50 or over
Under 3	BMI difference	+1.1	+0.6	*	*	*	*	*
	Base	*99*	*87*					
3–5	BMI difference	−0.2	1.1	1.7	*	*	*	*
	Base	*44*	*145*	*57*				
6–8	BMI difference	*	1.1	1.2	*	*	*	*
	Base		*105*	*100*				
9–12	BMI difference	*	2.4	1.1	0.6	0.3	*	*
	Base		*31*	*191*	*99*	*32*		
13–20	BMI difference	*	*	1.7	1.2	1.2	0.6	−1.4
	Base			*32*	*212*	*217*	*75*	*74*
21 or more	BMI difference	*	*	*	*	1.8	0.6	0.1
	Base					*74*	*211*	*766*

* *Sub sample too small for reliable estimate of average*

Appendix A Sample design and response

The sample

The study was required to be representative of the adult population, within the age range 16–64 inclusive living in Great Britain. The area covered included England, Wales and mainland Scotland; the Scottish islands were excluded for reasons of economy.

Knowledge of social class and age distributions within the population and the type of analysis of height and weight data required suggested that an achieved sample of approximately 10,000 individuals was necessary. Individuals were sampled through households; in other words, all eligible individuals were interviewed in a sample of households. This approach achieves, on average, two interviews at each address* instead of one, and achieves substantial economies since interviewer travelling time between addresses is a major fieldwork cost. Sample clustering in this way raises the problem of the household effect, that is, the propensity of individuals within the same household to be more alike than individuals from different households. However, in this survey the household effect on the data analysed is negligible. In most cases analysis by age and sex keeps members of the same household in different categories. However, one advantage that does accrue from this household design of the sample is the opportunity to examine the household effect, at least in terms of the height and weight of marriage partners.

A multi-stage design was adopted, in which the Primary Sampling Units (PSUs) were 100 local authority districts stratified by type (metropolitan and non-metropolitan) within region and ordered by the proportion of their population defined as being in Social Classes I–III, according to the 1971 Census. The resulting distribution by region and area type is shown in Table A1.

Within each selected district two wards were randomly selected with probability proportional to size of electorate. In some cases where ward populations were small (ie under 200) contiguous wards were merged and treated as a single ward. The final selected households from the chosen wards was achieved by a systematic selection† from the electoral register, including a household in the sample only if the elector through whom it was selected is the first one listed in the register. This system, known as firsting, gives all households an equal chance of selection regardless of the number of electors which each contains.

Some types of household are not adequately represented on the electoral registers. These include those in new property, households containing recent immigrants and any not entitled to vote, and where no-one has registered at the address. The best estimate of this shortfall is about 4% overall.[22]

Addresses which did not contain a private household (institutions) and were identifiable as such from the electoral register, were excluded from the sample.

* The OPCS General Household Survey shows an average of just over 2 adults per household in Great Britain.

† Systematic selection: Total population ÷ number to be sampled = sampling interval. After a random start within the sampling interval to identify the first selection, the interval is added on to the starting point to identify the next selection, and so on. This procedure is continued until the population list is exhausted.

Table A1 Distribution of PSUs (districts) by 1979 electorate

Region	Metropolitan districts			Non-metropolitan districts			All districts		
	Electorate			Electorate			Electorate		
	Number	% of population	Sample % (rounded)	Number	% of population	Sample % (rounded)	Number	% of population	Sample % (rounded)
Scotland	1,951,899	4.8	5	1,810,608	4.5	4	3,762,507	9.3	9
North	895,851	2.2	2	1,462,211	3.6	4	2,358,062	5.8	6
Yorks & Humberside	2,512,266	6.2	6	1,133,272	2.8	3	3,645,538	9.0	9
North West	3,102,843	7.7	8	1,711,737	4.2	4	4,814,580	11.9	12
East Midlands	—	—		2,810,766	7.0	7	2,810,766	7.0	7
West Midlands	1,987,606	5.0	5	1,815,214	4.5	5	3,802,820	9.4	10
East Anglia	—	—		1,354,903	3.4	3	1,354,903	3.4	3
Greater London	5,196,780	12.9	13	—	—		5,196,780	12.8	13
Rest of South East	—	—		7,391,837	18.3	18	7,391,837	18.3	18
South West	—	—		3,233,241	8.0	8	3,233,241	8.0	8
Wales	—	—		2,083,799	5.2	5	2,083,799	5.2	5
Total	**15,647,245**	**38.8**	**39**	**24,807,588**	**61.5**	**61**	**40,454,833**	**100.0**	**100**

These include for instance prisons and borstals, which would be difficult to gain access to, and boarding schools and old people's homes, where residents would be outside the set age range for this survey. Where an address was found by the fieldworker to be non-private (eg an hotel) no interview was taken.

In some cases where an address contained more than one household, the procedure used was that of the OPCS General Household Survey (GHS). Addresses on the Electoral Register containing four or more surnames were selected with probability proportional to the number of surnames. At these addresses the fieldworker listed all the households found there, and in the great majority of cases selected one household from the list according to a table of random numbers. (On rare occasions when the number of surnames proved to be a bad proxy for the number of households, this procedure could result in nil interviews or in two or three interviews at an address.) At some addresses, however, there was no indication on the Electoral Register that more than one household may be found, but extra households were discovered when the fieldworker called. At such addresses, fieldworkers were instructed to interview all the eligible households up to a maximum of three. There was no deletion of addresses later in the quota to compensate for these extra interviews.

As a result of the deletion of ineligible addresses and of these multi-households procedures, the number of households to be contacted differed from the original set sample (see Table A2).

After the size and design of the sample had been determined some allowances had to be made for non-response and ineligible households. The pilot results suggested that a response rate of 80% or more should be attainable: data from the GHS revealed that 24% of households contain only people of 65 years and over, 3% of addresses would be unoccupied,* and with an average of just over two adults† per household 5000 households had to be interviewed.

On that basis:

$$\left\{\frac{100}{76}\right\} \times \left\{\frac{100}{80}\right\} \times \left\{\frac{5{,}000}{1}\right\} \times \left\{\frac{100}{97}\right\} = 8{,}479$$

Proportion of households including people aged 16–64	Estimated response rate	Achieved number of households required (2 subjects per household)	Allowance for empty houses	Set sample of households required

* Estimated using 1971 Census figures giving the proportion of people in private households, the Annual Abstract of Statistics for newly completed properties (assuming these to be occupied at the rate of building), the OPCS Vacant Properties Survey, [23] and Gray and Gee.[24]

† There being just over two adults per household also compensates for the loss of handicapped and impaired people for whom measurement was impossible. These represent only 3.3% of the 16–64 population. Of these only 9% live alone, so only 0.29% of households (9% of 3.3%) should produce no 'eligible' information for reasons of disability (Harris[25]).

Table A2 Household response rates

Drawn sample from the electoral register (addresses)	*8,500*	
Ineligible Addresses: Empty properties, institutions, occupant disabled	*414*	
other	*2,062*	
All occupants out of age range 16–64	*6,024*	
Total eligible addresses		
Eligible households resulting*	*6,133*	100%
Household interviews obtained	*5,004*	82%
with all household members	*(4,518)*	(74%)
with some but not all household members	*(486)*	(8%)
Households refusing	*918*	3%
Households not contacted	*211*	3%
away all survey period	*(44)*	(1%)
out after at least 4 calls	*(167)*	(2½%)

* *Some addresses yield more than one household (see multi-household procedures).*

Thus fieldworkers were expected to find nearly a quarter of their quota of work to be ineligible households (containing only people over 64). Fieldworkers were briefed to ascertain the age composition of the sampled household during the doorstep contact and explain to the elderly ineligibles that "we would not need to bother you further . . . . .".

The field work was carried out between 21 July 1980 to 7 October 1980, with the bulk of interviewing (99%) finished by the end of September 1980.

Response

Table A2 shows the household response rate with percentages based on the number of households believed[a] to contain people eligible for interview. Interviews and measurements were achieved in 82% of eligible households, and in 74% of such households all eligible subjects were measured.

Individual response

The survey is essentially one of individuals sampled via the households in which they lived, Table A3 presents an estimate of the individual response rates which showed 77% among men and 81% among women.* Although the sampling of individuals via households saves fieldwork costs, it does mean that one individual can refuse the fieldworker access to the rest of his/her household and thereby deny other potential respondents the chance to participate, and 2% of the sample were lost in this way. Only 1% refused because they would have to be weighed, the remaining refusals being due largely to anti-survey or anti-government feeling.

[a] For the 3% of such households with which no successful contact was made and the 15% which refused to co-operate, it has been assumed that at least one adult would have been eligible for interview, so as to avoid the risk of exaggerating the response. Thus the response rates quoted are a conservative estimate, for it would seem likely that at least some of these households did not contain anyone under 65.

* As with the household response rates, these figures represent a conservative estimate, since they assume that all the refusers whose age was unknown were in the eligible age range 16–64.

Table A3 Individual response, for households where eligible interviews existed

	Men		Women		Total	
Individuals in households	6,534		6,603		13,137	
Ineligible individuals (Out of age range 16–64)	283		86		369	
(disabled)	8		11		19	
Eligible individuals	6,243	100%	6,506	100%	12,749	100%
Interviews achieved	4,777	77%	5,241	81%	10,018	79%
Non-contacts	343	5%	245	4%	588	5%
Refusals because weighing was required	32	1%	60	1%	92	1%
Refusal of access by other household member	181	3%	96	1%	277	2%
Other refusals	910	15%	864	13%	1,774	14%

Fieldworkers were required to give details of all calls they made on a sampled address and to seek some information about the household members they were unable to interview.

Weighting by age within region

Age and regional distributions from the achieved sample were compared against the most recent OPCS population estimates available and the result is shown in Table A4. It can be seen that there is some under-representation of the 20–29 age group and over-coverage of the middle age bands. Similarly the northern regions are slightly over-represented whilst there are not quite enough cases in the South East. So the data have been weighted by age within region separately for men and women.

Table A4 Comparison of survey and population distributions of age and region within sex

	Men		Women	
	Survey proportion	Population* proportion	Survey proportion	Population* proportion
Region	%	%	%	%
North	7	6	7	6
Yorks and Humberside	9	9	9	9
North West	12	12	13	12
East Midlands	7	7	8	7
West Midlands	10	10	10	10
East Anglia	3	3	3	3
Greater London	12	13	12	13
South East (Rest of)	18	19	17	18
South West	8	8	8	8
Wales	5	5	5	5
Scotland	9	9	9	9
Age				
16–19	10	10	10	10
20–29	22	23	20	22
30–39	22	22	23	21
40–49	19	18	19	18
50–59	19	19	19	20
60–64	7	7	8	8
Base (excluding those not giving age)†	*4,771*		*5,223*	

* *OPCS* Population estimates 1979 *Series PPI no 4, Table 3; GRO Scotland* Population estimates 1979 *Table 2 (excl. Islands).*

† *18 women and 6 men did not give their age but were included within the sample because the fieldworker judged them to be within the age range 16–64. Within the post-stratification weighing matrix these 24 cases carried a weight of 1.*

Table A5 Height and weight information on non-respondents

		Men		Women	
		Survey respondents*	Non-respondents	Survey respondents*	Non-respondents
Average height	cms	174	174	161	162
	Base	*4,713*	*860*	*5,174*	*813*
Average weight	kilos	74.2	74.9	62.1	61.7
	Base	*4,560*	*434*	*4,997*	*321*
		Pilot survey		*Pilot survey*	
Interviewer coding		%	%	%	%
O (overweight)		8	15	12	26
A (average)		87	79	84	67
U (underweight)		6	6	5	7
Base		*95*	*461*	*102*	*547*

* *Based on unweighted data, but weighted survey averages did not differ by more than 2mm*

Possible non-response bias

For the majority of non-respondents fieldworkers were able to gather some information on height. Proxy information on approximate height and weight distribution was taken from close relatives and if fieldworkers saw a non-respondent they were permitted to estimate his height for non-response records. Fieldworkers were not, however, permitted to estimate the weight of non-respondents since this was thought to be too prone to error. Thus the proportion of non-respondents for whom weight is available is not much in excess of one in four. However, fieldworkers were instructed, for those non-respondents they did manage to contact, to code O (for clearly overweight), U (for clearly underweight) and A (average) for the rest. Of course, there is no national standard against which to compare these data but during the pilot survey (undertaken at the planning stage of the project) fieldworkers were instructed to attempt this coding for the entire sample. This pilot data distribution is shown for comparative purposes in Table A5.

The average weight of respondents and reported non-respondents appears to be quite similar in Table A5 but the O/U/A coding suggests some under-representation of over-weight adults, if the *pilot* survey results are assumed to be representative.

Appendix B Measurement accuracy, variability and interviewer bias

For economic reasons it was only feasible to send one fieldworker to each sampled address so it was not possible to make an independent check of each measurement. The survey feasibility study had shown that apart from the risk of misreading of the dial there was no significant problem of measurement variability in taking weight. However, accurate height measurement was found to be dependent on measurer technique and informant stretch so an experiment was set up to estimate the level of variability likely to be present in the survey results. Again for reasons of economy the experiment had to be conducted when fieldworkers were assembled at the same site as the volunteer measurees at the end of the training sessions in the London Head Office of OPCS. Altogether 41 fieldworkers took part in the experiment spread over 3 separate sessions (one with 15 present, one with 14 and one with 12). The same eight volunteers were measured in each session by each fieldworker present. All of the volunteers were members of OPCS Head Office staff with no special knowledge of the survey. There was no pattern in the allocation of fieldworkers to experimental measuring sessions, but no special measures were taken to randomise it as such.

To estimate measurement variability the mean measured height of each volunteer was calculated together with its standard deviation and the results are shown in Table B1. If it is assumed that the mean measured height represents the best estimate of true height then the standard deviation provides an indicator of measurement variation. However this measured variation must be viewed with some caution as it may sometimes give an exaggerated result. The very effort of stretching up is an unusual exercise for most people and soon proves tiring. Thus for three out of the eight volunteers measured a number of times in a half hour period, there was a clear decline in achieved height as the measurement session continued.

The capacity of individuals to stretch themselves up declines with age, but it can also decline over the course of the day and even with the pattern of physical activity of the subject prior to the time of measurement. Since these factors could not be made identical for the volunteers over all three measurement sessions it was thought better to show the results for each session separately.*

Moreover there is evidence to suggest that three of the volunteers were achieving significantly† lower stretched height in consecutive sessions of the experiment (see Table B1) due perhaps to a loss of interest and motivation towards the aims of the exercise.

* Four extra volunteers were available in the first session only and their results are shown for the session in which they were present. (Their results were excluded from the interviewer bias data in Table B2.)
† Student's t test significant at 1% level. (Homoscedacity established by F test at 5% level.)

Table B1 Measurement variation: experiment results

	Volunteer number											
	1	2	3	4	5	6	7	8	9	10	11	12
Session 1												
Average height†	182.8	169.1	148.0	164.5	189.0	163.5	185.2	178.8	163.7	158.4	160.4	155.0
Standard deviation	0.13	0.13	0.26	0.20	0.31	0.32	0.18	0.24	0.31	0.23	0.22	0.14
IMU*	0.2%	0.2%	0.7%	0.4%	0.6%	0.9%	0.3%	0.4%	0.6%	0.5%	0.5%	0.3%
Session 2												
Average height†	—	168.8	148.1	164.0	188.8	163.5	184.8	—	164.5	—	160.4	—
Standard deviation	—	0.18	0.18	0.15	0.42	0.33	0.12	—	0.41	—	0.20	—
IMU*	—	0.4%	0.3%	0.3%	0.7%	0.5%	0.2%	—	0.9%	—	0.4%	—
Session 3												
Average height†	—	168.5	148.3	164.0	188.5	163.5	184.9	—	164.8	—	160.4	—
Standard deviation	—	0.28	0.18	0.62	0.48	0.24	0.16	—	0.17	—	0.17	—
IMU*	—	0.4%	0.3%	0.4%	0.7%	0.4%	0.3%	—	0.4%	—	0.3%	—
Weighted average of all 3 sessions												
Average height†	—	168.8	148.1	164.2	188.8	163.5	185.0	—	164.3	—	160.4	—
Standard deviation	—	0.19	0.21	0.30	0.40	0.30	0.15	—	0.31	—	0.20	—
IMU*	—	0.3%	0.4%	0.4%	0.7%	0.6%	0.3%	—	0.7%	—	0.4%	—

* IMU = Index of maximum underestimation (see page 55)
† These averages are based on the individual session averages *weighted* by the number of measurements (interviewers) in the session

Table B1 shows that the greatest standard deviation for any volunteer in any session found was 0.6cms but the majority of the standard deviations were less than 0.3cms. The weighted averages over all sessions‡ shows a standard deviation of 0.4cms for one volunteer but the average over all volunteers was only 0.26cms. Thus, on average, one would expect measured height to be within 0.5cms of the mean on 95% of all measurement occasions.

It might be argued that the problem of a measurement survey is not random measurement error but rather a general tendency to underestimate height. If one is willing to assume that the greatest measured height recorded for any individual volunteer is likely to be his or her true height° then it is possible to look at the extent to which other recorded heights underestimate this 'true' figure. In Table B1 an additional figure has been calculated using the data in this way and referred to as the Index of Maximum Underestimation (IMU). This is quite simply the shortfall of the lowest height recorded for a given volunteer as percentage of the highest height recorded for that same subject. Thus:

$$100 - \left\{ \frac{100 \times \text{minimum recorded height}}{\text{maximum recorded height}} \right\} = \text{IMU}$$

The worst result in any session was an IMU of 0.9% but the weighted averages show that the worst average result was 0.7%. The average IMU for all volunteers was 0.5% which considered against the average height for all volunteers (167.9cms) represents a *maximum* underestimation of 0.8cms. However, it should be remembered that subjects are normally only measured once or twice in the field and in no experimental session was the minimum recorded height taken at the first or second measuring, so the true underestimation would probably be less than the maximum implied by the IMU. To give some indication of the extent to which IMU does exaggerate underestimation an alternative measure was calculated, namely the shortfall of the first recorded height* in the session for a given volunteer as a percentage of the maximum recorded height for the same individual. This data was only available for two of the three experimental sessions†, but the average shortfall over these sessions was found to be 0.2%, which compared against the average volunteer height of 167.9cms represents an underestimation of 0.3cms.

Table B2 Average of all 8 volunteer's heights measured by each fieldworker

Average height of volunteer measured by fieldworkers (cms)	Number of fieldworkers achieving specified average height in session		
	Session 1	Session 2	Session 3
168.1	0	3	1
168.0	6	1	2
167.9	7	3	3
167.8	1	6	2
167.7	0	2	2
167.6	0	0	1
167.5	0	0	1
Total number of fieldworkers in session	14	15	12
Average height over all fieldworkers (cms)	167.9	167.9	167.8

To identify individual fieldworker bias the average of all the heights measured was calculated separately for each interviewer. If any particular fieldworker was making biased measurements it would have shown in an average value noticeably different from the rest. The results are shown separately for each session (in Table B2) and it can be seen that nearly all the values are grouped within 0.2cms of the session mean. In other words the results imply that the survey is very unlikely to have suffered from significant individual interviewer bias.

Indeed one of the strengths of a survey which uses a large number of fieldworkers (over a hundred) is that a small bias on the part of any one interviewer will not have a significant effect on the overall results.

‡ See footnote† of Table B1.

° Of course there is always a possibility that the maximum recorded height was a misreading or recording error.

* Even this measure is not necessarily the same thing as the measurement taken in the field where the subject believes that he only has one chance to achieve his maximum height.

† The order in which fieldworkers measured each volunteer was not recorded for the first experimental session.

Appendix C The schedules

Interview schedule

NATIONAL HEIGHTS AND WEIGHTS SURVEY

Interviewer ______________ Auth. no. ______________

Area no.			Add.no.		h/h

(7–12)

1	2			3	4				5	6	7	8	9	10
Enter person number for all aged 16-64 ONLY (plus HOH)	RELATIONSHIP TO HOH (MEMBERS OF HOUSEHOLD ONLY)			SEX	AGE				MARITAL STATUS	INTERVIEWER CODE only for age 16 -64 and HoH				
		Brothers Sisters	OFF. USE	M F	Date of birth			Age last birthday	Married Single Widowed/Divorced/Separated	Self completion form	Height taken	Weight taken	White schedule interview	C W N
1	HOH			1 2					1 2 3	1	1	1	1	1 2 3
				1 2					1 2 3	1	1	1	1	1 2 3
				1 2					1 2 3	1	1	1	1	1 2 3
				1 2					1 2 3	1	1	1	1	1 2 3
				1 2					1 2 3	1	1	1	1	1 2 3
				1 2					1 2 3	1	1	1	1	1 2 3
				1 2					1 2 3	1	1	1	1	1 2 3
				1 2					1 2 3	1	1	1	1	1 2 3
				1 2					1 2 3	1	1	1	1	1 2 3
				1 2					1 2 3	1	1	1	1	1 2 3
(13–4)		15	16	17	(18–23)			(24–5)	26	27	28	29	30	31

EMPLOYMENT

	HOH	2	
TO ALL			
11 Did you do any paid work last week - that is in the 7 days ending last Sunday - either as an employee or self-employed? Yes	1 go to Q12A	1 go to Q12A	1
No	2 ask (a)	2 ask (a)	2
IF NO (a) Even though you weren't working, did you have a job that you were away from last week? Yes	1 go to Q12A	1 go to Q12A	1
No	2 ask (i)	2 ask (i)	2
IF NO (i) Last week were you: waiting to take up a job that you had already obtained?	1	1	1
looking for work?	2 ask at Q12A	2 ask Q12A	2
or intending to look for work but prevented by temporary sickness or injury?	3	3	3
or retired?	4 ask Q12B	4 ask Q12B	4
NONE OF THESE	5 go to Q14	5 go to Q14	5
OCCUPATION — OFFICE USE ONLY — SC / SEG / SIC			
IF WORKING OR 1-3 at (i)			
12A What is your job? What do you actually do? RECORD MAIN JOB IN COLUMN AND CHECK (i) & (ii) BELOW			
(i) Employee....	E	E	E
Self employed....	S	S	S
IF MANAGER, SUPERINTENDENT, OR SELF-EMPLOYED (ii) No. of employees in establishment:			
None.....	A	A	
1-24.....	B	B	
25 or more.....	C	C	A B C
IF RETIRED AND OVER RETIREMENT AGE (code 4 at (i))			
12B What was the job you did for most of your working life? RECORD MAIN JOB IN COLUMN AND CHECK (i) and (ii) ABOVE			
13 INDUSTRY What does the firm/organisation you work for actually make or do?			

Q12A	1	1	1	1	7	Yes
	2	2	2	2		No
Q12A	1	1	1	1	8	Yes
	2	2	2	2		No
					9	
	1	1	1	1		waiting to take job
Q12A	2 ask Q12A	2 ask Q12A	2 ask Q12A	2 ask Q12A		looking for work
	3	3	3	3		intending to look but for illness
2B	4 ask Q12B	4 ask Q12B	4 ask Q12B	4 ask Q12B		retired
Q14	5 go to Q14	5 go to Q14	5 go to Q14	5 go to Q14		NONE OF THESE
					10	SC
					11 12	SEG
					13 14	SIC
	E	E	E	E		Employee
	S	S	S	S		Self-employed
	A	A	A	A		None
	B	B	B	B		1-24
	C	C	C	C		25 or more

IF FATHER NOT INTERVIEWED

Father interviewed .... ENTER PERSON NO. OF FATHER → see Q15 | see Q15

14. And what sort of work did your father do for most of his working life?

PROBE FOR DETAIL — SC

AND RECORD IN APPROPRIATE COLUMN →

IF ADOPTED ASK ABOUT ADOPTIVE FATHER

Father was: employee	A	A
self-employed	B	B

survey this strip should be cut off at the broken line

Q1	see Q15	see Q15	see Q15	see Q15	15 16 17
A B	A B	A B	A B		employee self-employed

TO ALL OVER 30 YEARS OLD

Informant aged 16-30 ..... | 1 ask Q16 | 1 ask Q16

15. Most people find that their weight changes from time to time. Can you remember how much you weighed when you were 21?

RECORD WEIGHT AT 21 → IF DON'T KNOW ASK (a) | ---stn---lbs go to Q16 | ---stn---lbs go to Q16

IF D/K AT Q15

(a) Would you say you weighed more now than when you were 21, or less or about the same?

Weigh more now	1	1
less now	2	2
about the same	3	3

16. May I just check, do you have any long-standing illness or disability or infirmity?

Yes	1 - record at left	1 - record at left
No	2 go to Q17	2 go to Q17

Person No. ----- DESCRIBE	Person No. ----- DESCRIBE
Arthritis - part of body?	Arthritis - part of body?
Thyroid - over or underactive?	Thyroid - over or underactive?

17. During the two weeks ending yesterday, did you have to cut down on the things you usually do because of (this illness/ disability or some other) illness or injury?

Yes	1	1
No	2	2

18. And during those 2 weeks have you suffered from .....

INDIV. PROMPT

shortness of breath?	1	1
tiredness?	2	2
pain in your back or limbs?	3	3
or hips or knees?	4	4
NONE OF THESE	5	5

thsurvey this strip should be cut off at the broken line

1 ask Q16	1 ask Q16	1 ask Q16	1 ask Q16	18	
____stn____lbs go to Q16	____stn____lbs go to Q16	____stn____lbs go to Q16	____stn____lbs go to Q16	19-22	WEIGHT AT 21
				23	
1	1	1	1		weigh more now
2	2	2	2		less now
3	3	3	3		about the same
				24	
1 - record at left	1 - record at left	1 - record at left	1 - record at left		Yes
2 go to Q 17	2 go to Q17	2 go to Q17	2 go to Q17		No
				25 26	
				27	
1	1	1	1		Yes
2	2	2	2		No
				28	
1	1	1	1		short of breath
2	2	2	2		tiredness
3	3	3	3		pain in back/limbs
4	4	4	4		hips/knees
5	5	5	5		none of these

7

PREAMBLE - RELATIVES

IF CURRENTLY MARRIED

Not currently married	1	see Q20	1	see Q20	1
Single (Never married).....	2	see Q21A	2	see Q21A	2

19 How many years have you been married?

ENTER NUMBER (TO NEAREST YEAR) ----

IF DIV, WID, SEP/SPOUSE NOT AVAILABLE

Spouse available for interview .... ENTER PERSON NO	----	see Q21A	----	see Q21A	----

20 Is/was your wife/husband taller than you, about the same height or shorter?

spouse taller	1		1	1
same height	2		2	2
shorter	3		3	3

ASK IF NOT ALREADY KNOWN ABOUT PARENTS

If known code →

21A Can I just check, is your father still alive?

Yes	1		1		1
No	2	ask Q21B	2	ask Q21B	2
Don't know	3		3		3
(SPON) Adopted	4	go to Q29 (p.14)	4	go to Q29 (p.14)	4

21B And is your mother still alive?

Yes	1		1	1
No	2		2	2
Don't know	3		3	3

8

20	1	see Q20	1	see Q20	1	see Q20	1	see Q20	29										
1A	2	see Q21A	2	see Q21A	2	see Q21A	2	see Q21A		Not married									
									30										
									31										
									32										
1A		see Q21A		see Q21A		see Q21A		see Q21A	33										
									34										
	1		1		1		1			spouse taller									
	2		2		2		2			same height									
	3		3		3		3			shorter									
									35										
1B	1		1		1		1			yes									
	2	ask Q21B	2	ask Q21B	2	ask Q21B	2	ask Q21B		no									
	3		3		3		3			don't know									
29	4	go to Q29	4	go to Q29	4	go to Q29	4	go to Q29		adopted (SPON)									
14)		(p.14)		(p.14)		(p.14)		(p.14)											
									36										
	1		1		1		1			yes									
	2		2		2		2			no									
	3		3		3		3			don't know									

IF FATHER OF INF. NOT INTERVIEWED
Father interviewed ....ENTER HIS PERSON NO → ------ see Q24 ------ see Q24

22. Can you tell me exactly how tall your father was (at his tallest)?

Yes ENTER → ---ft---ins go to Q23 ---ft---ins go to Q23

Can't say ..... N ask (a) N ask (a) N

IF CAN'T SAY
(a) Would you say that you are taller than your father, about the same height or shorter?

taller than father	1	1
about the same	2	2
shorter	3	3

23. When your father was about the age you are now was he on the heavy side, or about average or was he inclined to be a little underweight?

on heavy side	1	1
about average	2	2
underweight	3	3
(SPON) slim	4	4
Don't know	5	5

IF MOTHER INTERVIEWED
Mother interviewed ....ENTER HER PERSON NO → ____go to Q26 ____go to Q26

24. Can you tell me exactly how tall your mother was (at her tallest)?

Yes ENTER → ---ft---ins go to Q25 ---ft---ins go to Q25

Can't say ..... N ask (a) N ask (a) N

IF CAN'T SAY
(a) Well, would you say that you are taller than your mother, about the same height or shorter?

taller than mother	1	1
about the same	2	2
shorter	3	3

25. When your mother was about the age you are now was she on the heavy side, or about average, or was she inclined to be a little underweight?

on heavy side	1	1
about average	2	2
underweight	3	3
(SPON) slim	4	4
Don't know	5	5

10

the survey this strip should be cut off at the broken line

---- see Q24	----- see Q24	----- see Q24	----- see Q24	37 38	father interviewed
				39-41	
t ft ins go to Q23	ft ins go to Q23	ft ins go to Q23	ft ins go to Q23		yes
a) N ask (a)	N ask (a)	N ask (a)	N ask (a)		can't say
				42	
1	1	1	1		taller than father
2	2	2	2		about the same
3	3	3	3		shorter
				43	
1	1	1	1		on heavy side
2	2	2	2		about average
3	3	3	3		underweight
4	4	4	4		slim
5	5	5	5		don't know
26 ----go to Q26	-----go to Q26	----- go to Q26	----- go to Q26	44 45	mother interviewed
				46-48	
t ft ins Q2 go to Q25	ft ins go to Q25	ft ins go to Q25	ft ins go to Q25		yes
a) N ask (a)	N ask (a)	N ask (a)	N ask (a)		can't say
				49	
1	1	1	1		taller than mother
2	2	2	2		about the same
3	3	3	3		shorter
				50	
1	1	1	1		on heavy side
2	2	2	2		about average
3	3	3	3		underweight
4	4	4	4		slim
5	5	5	5		don't know

TO ALL AGED 18 OR OVER

	Inf. under 18	1	go to Q29	1 go to Q29	1
26	Can I just check, do you have, or did you once have any brothers?				
	Yes	1	ask (a)	1 ask (a)	1
	No	2	go to Q27	2 go to Q27	2
	(a) Did he (they) reach the age of 18?				
	Yes, one or more reached 18	1	ask (i)	1 ask (i)	1
	No	2	go to Q27	2 go to Q27	2
	(i) Once you had all stopped growing, were you taller than (all of) your brother(s)?				
	Yes, taller than brother(s)	1		1	1
	No, not the tallest	2		2	2
	(SPON.) about the same height	3		3	3
	Other answer	4		4	4
27	And can I just check, do you have, or did you once have any sisters?				
	Yes	1	ask (a)	1 ask (a)	1
	No	2	see Q28	2 see Q28	2
	(a) Did she (they) reach the age of 18?				
	Yes, one or more reached 18	1	ask (i)	1 ask (i)	1
	No	2	see Q28	2 see Q28	2
	(i) Once you had all stopped growing, were you taller than (all of) your sister(s)?				
	Yes, taller than sister(s)	1		1	1
	No, not the tallest	2		2	2
	(SPON.) about the same height	3		3	3
	Other answer	4		4	4
	IF INF HAD BROTHER/SISTER				
	No brother/sister	1	go to Q29	1 go to Q29	1
28	How many children did your mother have who survived until school age, including yourself?				
	RECORD NUMBER →	----		----	---
	(a) And were you the eldest child, or the second (or which)?				
	RECORD BIRTH ORDER →	----		----	---

12

the survey this strip should be cut off at the broken line

29	1	go to Q29	1	go to Q29	1	go to Q29	1	go to Q29	51	inf. under 18
									52	
7	1	ask (a)	1	ask (a)	1	ask (a)	1	ask (a)		yes
	2	go to Q27	2	go to Q27	2	go to Q27	2	go to Q27		no
									53	
7	1	ask (i)	1	ask (i)	1	ask (i)	1	ask (i)		yes, one or more 18
	2	go to Q27	2	go to Q27	2	go to Q27	2	go to Q27		no
									54	
	1		1		1		1			yes
	2		2		2		2			no
	3		3		3		3			about same
	4		4		4		4			other answer
									55	
	1	ask (a)	1	ask (a)	1	ask (a)	1	ask (a)		yes
	2	see Q28	2	see Q28	2	see Q28	2	see Q28		no
									56	
	1	ask (i)	1	ask (i)	1	ask (i)	1	ask (i)		yes
	2	see Q28	2	see Q28	2	see Q28	2	see Q28		no
									57	
	1		1		1		1			yes
	2		2		2		2			no
	3		3		3		3			about same
	4		4		4		4			other answer
									58	
	1	go to Q29	1	go to Q29	1	go to Q29	1	go to Q29		no brother/sister
									59	
									60	
									61	
									62	

13

RECREATIONAL EXERCISE

EX

REG

PREAMBLE

29 Have you been on holiday at all in the last 14 days?

Yes ..... Y ask (a) | Y ask (a)
No ..... N ask (b) | N ask (b)

IF ASKED: A HOLIDAY IS AT LEAST 2 DAYS, BUT IT NEED NOT INVOLVE GOING AWAY FROM HOME

SHOW CARD L

(a) Well thinking of the 14 days prior to your holiday have you taken part in any of the activities listed on this card in your spare time?

Yes ..... RECORD →
No ..... N - go to Q31 | N - go to Q31

SHOW CARD L

(b) Well, think of the 14 days ending yesterday, have you taken part in any of the activities listed on this card in your spare time?

Yes ..... RECORD →
No ..... N - go to Q31 | N - go to Q31

30 On how many days in that fortnight did you ..... or ..... (ACTIVITIES MENTIONED ABOVE)? →

RECORD TOTAL NUMBER OF DAYS IN LAST 14, WHEN ANY OF THE LISTED ACTIVITIES WERE DONE

PREAMBLE

31 (a) In which town or village were you born?
ENTER TOWN/VILLAGE →

(b) And in which county was that?
ENTER COUNTY →

3	4	5	6	
				63
				64
				65
Y ask (a) N ask (b)	Y ask (a) N ask (b)	Y ask (a) N ask (b)	Y ask (a) N ask (b)	yes no
N - go to Q31	N - go to Q31	N - go to Q31	N go to Q31	no
				IF YES RECORD
N - go to Q31	N - go to Q31	N - go to Q31	N - go to Q31	no

ASK HOH OR SPOUSE ONLY - Other are ready for self-completion forms

32. And can I just check, do you own this house/flat or do you rent it? (66)

Own	A ask (a)
Rent	B ask (b)
(SPONTANEOUS) live rent free	1

(a) Are you paying a mortgage or do you own it outright?

Mortgage	2
Own outright	3

(b) Do you rent from the Council or privately?

Council	4
Private	5

Office of Population, Censuses and Surveys,
St. Catherines House,
10 Kingsway,
London,
WC2B 6JP.

W744 OPCS 6/80

NATIONAL HEIGHTS AND WEIGHTS SURVEY

(7-14)

Day Mth Auth. No.

BLUE QUESTIONNAIRE

IN CONFIDENCE

Date (15-20)

People's clothing will obviously make a difference to their weight; so to help us allow for this we would like you to put a tick by any item that you will be wearing when you are weighed. If you will be wearing any item which is not on the list please add it at the end.

As shoes and jackets or coats are likely to be the heaviest items would you mind taking them off just before you are weighed.

Also if you are wearing heavy jewellery or have much loose change in your pocket please give these into the safe keeping of another member of your family whilst you are being weighed. If this is not possible please make a note of these items on the list.

Tick each item being worn

e.g.

Shirt	✓
Kilt	✓

ITEMS WORN WHILST BEING WEIGHED	TICK (21-2)	If you are wearing more than one please record how many (23-4)
Pair of socks	01	
Pants/briefs	02	
Vest	03	
T shirt	04	
Shirt	05	
Trousers	06	
Kilt	07	
Belt/braces	08	
Jumper	09	
Cardigan	10	
Tie/cravat	11	
Corset	12	
Something else not on list *Please write down*		

INTERVIEWER USE ONLY

NOW PLEASE ANSWER THE QUESTIONS INSIDE

H cms/mm (25-8)

Posture (29)

W kgs/0,5 (30-3)

Time (24 hr clock) (34-7)

2. It is known that people weigh more if they have recently had a meal. At what time did you eat your last meal? → _____ o'clock (38-41)

Was that am or pm?
(Note: NOON = pm)

am..... ☐ 1 (42)
pm..... ☐ 2

3. Did you have a snack between meals at any time yesterday: something like biscuits, cake, crisps or sweets?

Yes.... ☐ 1 (43)
No..... ☐ 2

4. How much would you say you weigh these days?

_____ Stone _____ Pounds (44-7)

5. Weight above is → - with some clothes on... ☐ 1 (48)
- without clothes... ☐ 2

6. Have you been on a slimming diet at any time in the last 12 months?

Yes.... ☐ 1 (49)
No..... ☐ 2

7. Are you on a slimming diet now?

Yes.... ☐ 1 (50)
No..... ☐ 2

8. If you are on a slimming diet now, how long have you been on it?

_____

OFFICE USE ONLY
☐ * (51)

9. Is there anything else about your current condition which might affect your weight?

IF YES: PLEASE GIVE DETAILS _____ * (57)

10. Do you smoke cigarettes at all nowadays?

Yes 1		(58)
No 2		

11. Do you smoke cigars or a pipe at all nowadays?

		(59)
Yes 1		
No 2		

12. When did you last smoke a cigarette, cigar or a pipe?

		(60)
some time today		1
some time in last 7 days		2
some time in last 12 months		3
up to 5 years ago		4
over 5 years ago		5
Never		6

13. How often do you usually have an alcoholic drink of any kind?

		(61)
almost every day		1
at least once a week		2
about once a fortnight		3
once a month		4
once every 3 or 4 months		5
once a year		6
less than once a year		7
Never		

THANK YOU

* DOES NOT APPLY TO EVERYBODY

Self-completion form for women

NATIONAL HEIGHTS AND WEIGHTS SURVEY

(7-14)

PINK QUESTIONNAIRE

Day Mth Auth. No.

Date (15-20)

IN CONFIDENCE

People's clothing will obviously make a difference to their weight; so to help us allow for this we would like you to put a tick by any item that you will be wearing when you are weighed. If you will be wearing any item which is not on the list please add it at the end.

As shoes and jackets or coats are likely to be the heaviest items would you mind taking them off just before you are weighed.

Also if you are wearing heavy jewellery or have much loose change in your pocket please give these into the safe keeping of ancther member of your family whilst you are being weighed. If this is not possible please make a note of these items on the list.

Tick each item being worn e.g.

Blouse	✓
Skirt	✓

ITEMS WORN WHILST BEING WEIGHED	TICK (21-2)	If you are wearing more than one please record how many (23-4)
Pair of socks	01	
Stockings/Tights	02	
Suspender Belt	03	
Pants/Briefs	04	
Corset/Girdle	05	
Bra	06	
Slip/Underskirt	07	
Vest	08	
Blouse	09	
T-Shirt	10	
Skirt	11	
Trousers	12	
Belt	13	
Dress	14	
Jumper	15	
Cardigan	16	
Waistcoat/Jerkin	17	
Something else not on list *Please write down*		

INTERVIEWER USE ONLY

NOW PLEASE ANSWER THE QUESTIONS INSIDE

H cms/mm (25-8)

Posture (29)

W kgs/0,5 (30-3)

Time (24 hr clock) (34-7)

2. It is known that people weigh more if they have recently had a meal. At what time did you eat your last meal? ——→ _____ o'clock (38-41)

Was that am or pm?

(Note: NOON = pm)

am..... ☐ 1 (42)

pm..... ☐ 2

3. Did you have a snack between meals at any time yesterday: something like biscuits, cake, crisps or sweets?

Yes.... ☐ 1 (43)

No..... ☐ 2

4. How much would you say you weigh these days?

_____ Stone _____ Pounds (44-7)

5. Weight above is ——→ - with some clothes on... ☐ 1 (48)

- without clothes... ☐ 2

6. Have you been on a slimming diet at any time in the last 12 months?

Yes.... ☐ 1 (49)

No..... ☐ 2

7. Are you on a slimming diet now?

Yes.... ☐ 1 (50)

No..... ☐ 2

8. If you are on a slimming diet now, how long have you been on it?

_____

OFFICE USE ONLY

☐ * (51)

(skip 52-6)

9. Have you ever been pregnant?

Yes	☐	1	(52)
No.....	☐	2	

10. Are you pregnant now?

if yes: how many weeks?	☐	*	(53-4)

11. How many children have you given birth to altogether?

Enter total number, including any children who now live somewhere else and who may have died. → ☐ * (55-6)

12. Is there anything else about your current condition which might affect your weight?

IF YES: PLEASE GIVE DETAILS _____ * (57)

13. Do you smoke cigarettes at all nowadays?

Yes	☐	1	(58)
No.....	☐	2	(skip 59)

14. When did you last have a cigarette?

some time today.....	☐	1	(60)
some time in last 7 days.....	☐	2	
some time in last 12 months.....	☐	3	
up to 5 years ago.....	☐	4	
over 5 years ago.....	☐	5	
Never	☐	6	

15. How often do you usually have an alcoholic drink of any kind?

almost every day	☐	1	(61)
at least once a week	☐	2	
about once a fortnight	☐	3	
once a month	☐	4	
once every 3 or 4 months.....	☐	5	
once a year	☐	6	
less than once a year	☐	7	
Never	☐	8	

THANK YOU

* DOES NOT APPLY TO EVERYBODY

CARD L

S1138

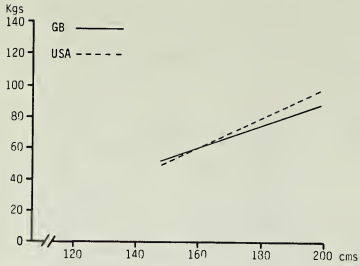
In your spare time have you personally....

- taken a walk of more than 2 miles or lasting over an hour
- been gardening for at least an hour at one time
- been swimming
- been jogging/running
- done gymnastics/keep fit or yoga
- been dancing
- taken part in any other energetic sporting activity or game
- taken any other form of energetic exercise

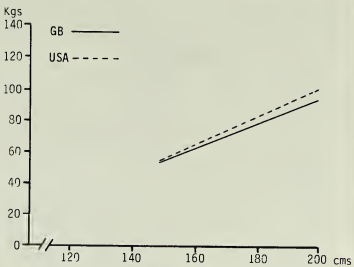
WS9/4 OPCS 9/80

Appendix D

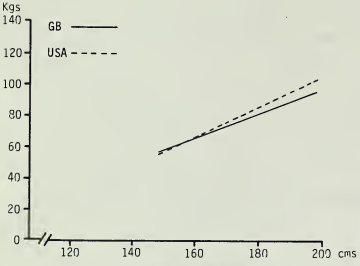
Regression of weight on height for men by age: GB and USA compared



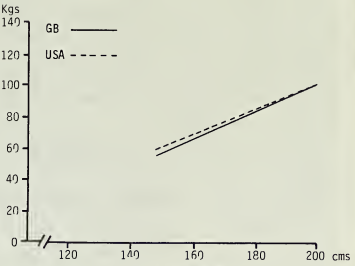
Men 18-24



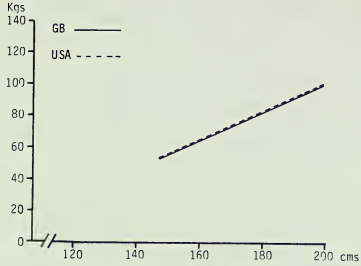
Men 25-34



Men 35-44

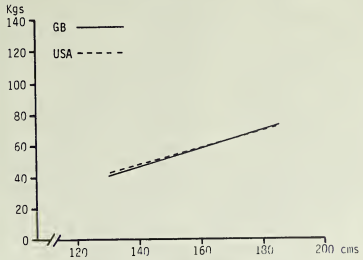


Men 45-54

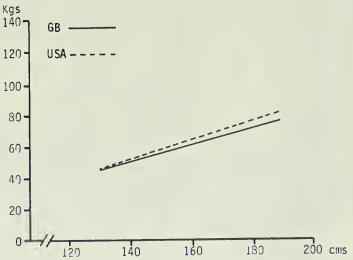


Men 55-64

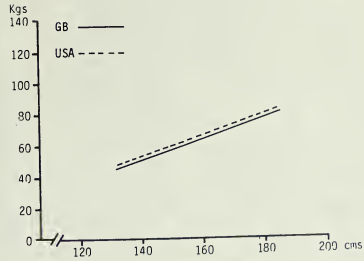
Regression of weight on height for women by age: GB and USA compared



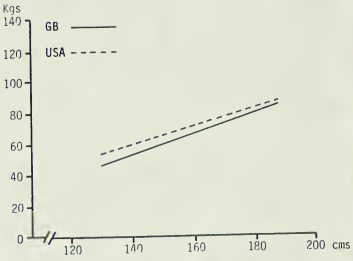
Women 18-24



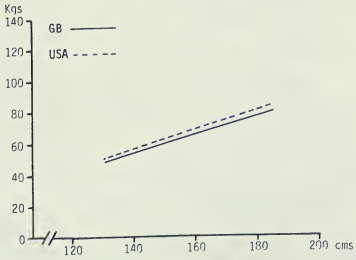
Women 25-34



Women 35-44



Women 45-54



Women 55-64

Appendix E Special interest tabulations

The Ponderal Index

Table E1 shows how the Ponderal Index $H/W^{\frac{1}{3}}$ compares with the Body Mass Index (Quetelet Index) $\frac{W}{H^2}$. Since W is the numerator in the BMI that index value increases as weight increases for a given height. In the Ponderal Index however, W is the denominator and the index value is bound to *decrease* as weight for a given height increases.*

Within the group referred to as overweight, though not obese, the average BMI was 26.9 for men and 27.0 for women while the Ponderal Index was 40.1 and 39.0 respectively. In the group which has been called obese average BMI for men and women was 32.4 and 33.5 respectively whereas the Ponderal Index averages were 37.7 and 36.3.

Table E2 shows the Ponderal Index distributions by age and reveal much the same picture as the equivalent BMI tables in Chapter 4. Table E3 shows the Ponderal Index by region but reveal even less regional difference than was found in the BMI tables. Average values of the Ponderal Index by social class within age group show a slightly greater tendency to be overweight in Social Class III manual, IV and V (Table E4).

Characteristics of obese women (RCP report definition)

In the Royal College of Physicians report on obesity,[1] they used the same threshold of BMI = 30 as this report to define obesity in men. But unlike this report they adopted a lower threshold (BMI = 28.6) to define obesity in women. To show the characteristics of the 12½% of women defined as obese in this way, Table E5 gives percentage distributions for some key variables.

* This is the version of the Ponderal Index popularised by Sheldon[26] *et al* (see Chapter 4).

Table E1 Comparison of average index values for Ponderal and Body Mass indices

	Men				Women			
	Underweight (BMI ≤20)	Normal (BMI 20.1–25)	Overweight (BMI 25.1–30)	Obese (BMI >30)	Underweight (BMI ≤20)	Normal (BMI 20.1–25)	Overweight (BMI 25.1–30)	Obese (BMI >30)
Average BMI	18.9	22.8	26.9	32.4	18.8	22.5	27.0	33.5
Average Ponderal Index	45.3	42.5	40.1	37.7	44.1	41.6	39.0	36.3
Base	*449*	*2,307*	*1,482*	*261*	*704*	*2,667*	*1,160*	*405*

Table E2 Percentage distribution of the Ponderal Index by age and sex

Ponderal Index distribution	All ages 16–64	16–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64
	%	%	%	%	%	%	%	%	%	%	%
	Men										
46 or more	2	9	4	2	1	1	1	1	1	0	1
44–45.9	12	33	22	14	10	8	5	4	5	7	6
41–43.9	49	49	54	56	56	53	48	46	44	41	38
38–40.9	33	9	19	26	31	35	42	44	47	46	49
Under 38	3	1	2	2	3	3	5	6	3	6	6
Base	*4,498*	*480*	*516*	*537*	*520*	*453*	*433*	*394*	*417*	*427*	*316*
Average	41.7	43.5	42.6	42.1	41.6	41.5	41.1	40.9	41.1	41.0	40.8
	Women										
46 or more	1	1	1	1	1	1	0	0	0	1	1
44–45.9	7	17	10	11	8	5	4	2	5	3	4
41–43.9	44	57	52	57	51	49	41	37	32	26	23
38–40.9	38	21	31	25	34	36	44	46	44	53	52
Under 38	11	3	5	6	6	9	11	14	19	18	19
Base	*4,935*	*497*	*547*	*556*	*559*	*492*	*481*	*413*	*491*	*484*	*398*
Average	40.9	42.2	41.6	41.6	41.3	41.0	40.5	40.4	40.1	40.0	39.8

Table E3 Percentage distribution of the Ponderal Index by region and sex

Ponderal Index distribution	Region										
	Scotland	North	Yorks and Humberside	North West	East Midlands	West Midlands	East Anglia	Greater London	Rest of South East	South West	Wales
	%	%	%	%	%	%	%	%	%	%	%
	Men										
46 or more	2	2	3	2	2	2	1	2	3	3	1
44–45.9	9	12	12	12	12	14	10	12	14	12	8
41–43.9	55	45	47	46	49	48	52	49	50	51	48
38–40.9	30	37	35	37	33	32	35	34	30	32	39
Under 38	5	3	3	3	4	4	2	4	3	3	4
Base	*397*	*262*	*368*	*546*	*332*	*446*	*134*	*551*	*861*	*384*	*217*
Average	41.7	41.6	41.6	41.6	41.6	41.7	41.6	41.7	41.9	41.8	41.3
	Women										
46 or more	1	1	1	1	1	1	1	1	1	0	0
44–45.9	8	7	8	7	7	7	7	9	8	7	3
41–43.9	44	41	45	44	38	40	42	44	48	40	43
38–40.9	37	40	35	38	44	42	39	36	34	39	43
Under 38	10	12	11	10	12	11	13	10	9	14	10
Base	*453*	*283*	*396*	*617*	*353*	*477*	*139*	*616*	*937*	*418*	*247*
Average	41.0	40.8	40.9	40.9	40.7	40.7	40.7	41.0	41.1	40.7	40.6

Table E4 Average Ponderal Index by social class within age groups

Social class		Men						Women					
		16–19	20–29	30–39	40–49	50–59	60–64	16–19	20–29	30–39	40–49	50–59	60–64
I and II	Index	44.0	42.7	41.9	41.2	41.1	40.8	42.5	41.9	41.6	41.1	40.4	40.3
	Base	*108*	*237*	*287*	*237*	*193*	*81*	*108*	*249*	*280*	*243*	*192*	*76*
III (non-manual)	Index	43.7	42.6	41.8	41.4	41.2	40.7	42.5	41.9	41.4	40.7	40.5	40.0
	Base	*60*	*115*	*101*	*80*	*84*	*36*	*59*	*137*	*110*	*103*	*154*	*54*
III (manual)	Index	43.2	42.0	41.3	40.8	40.8	40.8	42.0	41.4	41.0	40.1	39.8	39.6
	Base	*167*	*437*	*385*	*337*	*345*	*110*	*193*	*398*	*391*	*311*	*330*	*121*
IV and V	Index	43.3	42.4	41.4	40.8	41.2	40.8	42.0	41.4	40.6	40.1	39.9	39.2
	Base	*90*	*195*	*169*	*144*	*182*	*62*	*81*	*219*	*166*	*147*	*192*	*85*

Table E5 Characteristics of women with BMI of 28.6 or over

Characteristic	Percentage distribution of all women classified as obese by RCP definition (n = 619)	Obese women as a percentage of all women in the attribute group
Age last birthday	%	
16–19	4	4%
20–29	13	7%
30–39	17	10%
40–49	21	15%
50–59	31	20%
60–64	14	21%
Smoking and drinking habits		
Regular smoker only	20	13%
Regular smoker and drinker	13	9%
Regular drinker only	19	10%
Not regular smoker or drinker	47	17%
Symptoms in last fortnight		
short of breath	12	18%
tiredness	27	14%
pain in back or limbs	26	16%
pain in hips or knees	19	23%
none of these symptoms	51	11%
Takes snacks between meals		
Yes	26	11%
No	74	15%
Days of exercise in a week		
None	41	24%
One	17	12%
Two	14	11%
Three	6	8%
Four	5	9%
Over four	18	9%
Currently on a diet		
Yes	47	11%
No	53	13%

* *For example, 11% of all women on a diet were obese, although 47% of obese women were on a diet.*

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